

SOUTH

DAKOTA



**CLEGHORN FISH HATCHERY
ANNUAL PRODUCTION REPORTS
1998-2002**

**South Dakota
Department of
Game, Fish and Parks
Wildlife Division
Joe Foss Building
Pierre, South Dakota 57501-3182**

**Progress Report
No. 06-18**

**Cleghorn Fish Hatchery
Annual Production Reports
1998-2002**

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1998	Green
1999	Blue
2000	Golden Rod
2001	Lilac
2002	Yellow

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John Carreiro, Biologist

PREFACE

This document presents a summary of fish production and related activities during production years 1998-2002 (January 1 – December 31) at Cleghorn Springs State Fish Hatchery, Rapid City, South Dakota. Copies of this report and references to the data can be made by obtaining permission from the authors or the Director of the Division of Wildlife, South Dakota Department of Game, Fish, and Parks, 523 E. Capital, Pierre.

CLEGHORN FISH HATCHERY ***ANNUAL PRODUCTION REPORT 1998***

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LOCATION AND HISTORY

Cleghorn Springs Hatchery, located at the western edge of Rapid City on a 5.4A. Site bordered on the north side by Route 44 and on the south side by Rapid Creek has been in operation since 1928. The site was selected for and named after the large spring that drew homesteaders here in 1889. Hatchery operations housed at another site downstream were moved in after completion of the first facilities in 1928. A single story stone and brick building on the east end of the site served as the incubation, fry rearing and administrative facilities. Twelve earthen ponds fed by gravity surface spring water were used to rear fish to 6" stocking size. Renovations in circa 1934 created 29 smaller stone walled ponds with 7 earth ponds remaining. The hatchery remained relatively unchanged until the devastating flood of 1972, which destroyed the original building and all of the ponds. Fish stocking operations were maintained by obtaining fish from the United States Fish and Wildlife Service, McNenny Hatchery, neighboring states, and purchases during 1973. A new hatchery building and raceway complex was designed and constructed. Concrete raceways replaced the ponds while the surface spring intakes were replaced with an underground infiltration gallery and a new flood proof pre-cast concrete building completed the re-construction. In 1982, a recirculated water system was installed to increase utilization of the raceways which were originally oversized in anticipation of developing additional water. Although providing increased flow to the raceways; high dissolved nitrogen levels, low oxygen levels and suspended solids in the re-use water hampered production. The recirculation system was abandoned and a nitrogen degassing/oxygen supplementation system was added in the fall of 1988 resulting in improved production capabilities. Five 10' diameter circular tanks were installed indoors in 1995 to reduce labor demands and improve trout quality.

FACILITIES

PRODUCTION UNITS

160 Heath incubator trays in 8 stacked units
1 Eagar upwelling incubator
21 Heath Techna fiberglass start tanks 14.5' x 1.75' x 0.75'
5 Gemini 10' diameter x 4' deep circular fiberglass tanks
10 Concrete raceways 500' x 8' x 2' dividable into 4 ponds each
2 Concrete raceways 200' x 16' x 2' dividable into 4 ponds each

WATER PRODUCTION AND TREATMENT SYSTEMS

Spring water collected 15' underground flows by gravity pipeline to a 90 horsepower vertical axis turbine pump, which pumps it to two degassing towers. The main tower with four 3' o.d. x 6' high degassing columns supplies water by gravity to the head of the raceways at the west end of the raceways. The smaller tower, with one column, supplies water to the hatchery building. Degassing and re-oxygenation are accomplished in the sealed aluminum columns filled with 1-1/2" Flexiring diffusers. Three Airsep model AS 250 pressure swing absorption generators plumbed in parallel provide 100 liters /min of oxygen with 100% back up capacity. Two 40-hp Sullaire rotary screw air compressors supply air to the oxygen generators thru a 3/4 hp UltraAir dryer and a 400-gallon pressure tank. An emergency back-up system of twenty K size oxygen cylinders with a capacity of 5000 ft³ @ 2000 psi supplies emergency oxygen when system pressure drops below normal operating pressure. This bank is kept filled by a Haskell

pneumatic booster pump. Oxygen is also added to the 8 most heavily loaded raceways with portable oxygen contactors.

The hatchery discharge is permitted and monitored under National Pollution Discharge Elimination System (NPDES) permit # SD 0000060. Waste water is treated by gravity sedimentation in two parallel flow 30'x100'x3' settling basins prior to discharge to Rapid Creek. Settling basin sludge is recycled at the Rapid City composting site.

HATCHERY STAFFING

Hatchery Manager

Assistant Hatchery Manager

Biologist

1.8-Conservation Technicians

PRODUCTION SUMMARY

Total number, weight, and operational cost for fish stocked during calendar year 1998 at Cleghorn Springs are summarized in Table 1. Costs are based on direct labor, feed, production overhead, stocking, and site administrative overhead costs. Production overhead includes water pumping, degassing, oxygenation, and facility and grounds maintenance costs. These costs are prorated by unit weight to arrive at total production cost of a given fish lot. They do not include capital costs associated with the hatchery nor do they include administrative overhead above the site level. Unit cost may vary slightly among lots, but in general terms the cost to rear a fish of a given weight or age is constant.

Table 1. ---Calendar Year 1998 Stocking summary by program, species: rainbow trout (RBT), brown trout (BNT), size and cost.

Program	Species	Size	Number Stocked	Weight Stocked kilograms	Total Cost
Large Lakes and Reservoirs					
	RBT	Adult	40	222	\$ 1,611
	RBT	Catchables	45,000	5,000	\$ 36,232
	Program Sub-total		45,040	5,222	\$ 37,843
Missouri River					
	FCS	Fingerling	49,200	820	\$ 5,942
	RBT	Adult	42	42	\$303
	RBT	Catchable	16,572	1,691	\$12,253
	RBT	Fingerlings	307	104	\$ 751
	Program Sub-total		66,121	2,656	\$19,249
Small Lakes and Ponds					
	RBT	Adult	3,685	4,187	\$ 30,344
	RBT	Catchable	79,005	17,276	\$125,193
	RBT	Fingerling	84,210	520	\$ 3,771
	Program Sub-total		166,900	21,984	\$ 159,308
Streams					
	BNT	Catchable	12,925	2,943	\$ 21,328
	RBT	Catchable	16,300	5,078	\$36,796
	Program Sub-total		29,225	8,021	\$ 58,124
Total			307,286	37,884	\$ 274,525

Total accrued cost for each lot of fish is listed in the lot history (appendix 1). Monthly expenditure records are summarized by calendar year to obtain the annual costs associated with each lot. Annual costs are added to the accrued cost in the lot history. Total annual expenditures (Table 2.) reflect the cost of the total weight of fish produced during the year regardless of whether or not they were stocked or held over. Calendar year expenditures are similar to, but not equal to, fiscal budget year expenditures. This results from posting dates and fund balance transfers occurring at the end of fiscal year accounting cycles. The average cost per kilogram of production multiplied by the kilograms of production for a twelve-month period gives a figure

close to an average fiscal year operational budget. Table 3 illustrates how the calendar year labor was distributed.

Table 2.---- Calendar Year 1998 Operating Expenditures, Cleghorn Springs Hatchery.

Personal Services	\$	164,745
Travel	\$	2,859
Contractual Services	\$	78,481
Capital Expenditures	\$	27,627
Supplies and Materials	\$	46,960
<hr/>		
Total	\$	320,672

Table 3.---Labor Distribution by task Calendar Year 1998

SAM	1%
TROUT CULTURE	33%
STOCKING/FISH DISTRIBUTION	8%
FISH HEALTH MANAGEMENT	4%
SPAWNING AND EGG COSTS	1%
ADMINISTRATION	41%
EQUIPMENT MAINTENANCE	5%
BUILDING AND GROUNDS MAINTENANCE	4%
PROJECT ADMINISTRATION	0%
TRAINING & PRESENTATIONS	1%
OPER. & MAINT. OF INTERPRETIVE FAC.	1%
INTERPRETIVE/EDUCATIONAL MATERIALS	0%
DEVELOPMENT OF NEW FACILITIES	1%
<hr/>	
TOTAL	100%

BROODSTOCK ACTIVITIES

Mature brood fish are fed a brood diet to cut growth while maintaining condition. Younger brood fish are fed production diets until age 3. Spawning started in late August and ran through October. This year fish were reared separately by sex. Fish were sorted for ripeness every two weeks. Ripe fish were spawned the day after sorting. Females three years and older were air spawned; while 2 year olds, which are easy to handle, were hand spawned. Table 4 summarizes the 1998 operations. Total egg production hit 1,038,747 eggs. Just over 450,000 were used to meet production needs at Cleghorn; 279,000 were shipped to McNenny and the balance was discarded.

SUPPLY WATER QUALITY

Cleghorn Springs supplies an average 6 million gallons per day to the hatchery. Flow rates fluctuate, annually, seasonally, and with competitive demand from the Rapid City Jackson Springs pumping station. No significant fluctuations have occurred in the chemical nature of the water supply since 1973. Water levels remain high again this year. The water table is now only about 16 inches below the surface at some points around the hatchery.

FISH CULTURE ACTIVITIES

The large rainbow trout program continues to be very popular. No significant problems were encountered getting them up to size. Floating extruded pellet diets with canthaxanthin, a pigment that enhances skin and flesh color, continues to produce pleasing external and internal color in both brown and rainbow trout. Anecdotal accounts from anglers claim that these prettier fish also taste much better. Private industry relies heavily on these products to color both salmon and trout to compete with wild fish in the market.

FISH HEALTH

Cleghorn Springs Fish Hatchery continues to remain disease free. Furunculosis caused by *Aeromonas salmonicida* was last epizootic in 1987. We continue to monitor with Tryptic Soy Agar (TSA) slants. Improvements in management have prevented any furunculosis epizootics. Brown trout are in the last stages of being phased out of production at least temporarily at Cleghorn Springs. One last lot of fish will be reared in 1999. Brown trout production will be evaluated for future production when more is understood about the furunculosis risk.

The circular tanks are performing well with fingerling and larger trout. Fry are still started in rectangular tanks due to problems with mort removal and plugging of the center screens. A new screen system is being developed to overcome this problem. Despite the screens, the circular tanks have proven to save time and provide a good rearing environment with controllable current velocity.

RESEARCH

Incubation tests were initiated using an Eagar upwelling incubator. This is an updated design of a McDonald jar. Survival to hatch was 64% without the use of any fungicide. Additional trials will be conducted next year in our efforts to eliminate the use of formalin. The second year for the Sweeney feeders has revealed some minor problems with feed sizes, wind, and feed distribution down the raceways. We will continue to evaluate these units and look at corrective measures.

EFFLUENT WATER QUALITY

Cleghorn Springs Trout Hatchery operates under NPDES permit SD-0000060. Discharge limits are summarized in Table 5. Careful production programming and operating keep water quality within the permit limits set by the Environmental Protection Agency. Water is sampled and analyzed weekly for TSS (total suspended solids), BOD (biological oxygen demand), pH; and monthly for ammonia. A quarterly sample taken during pond cleaning is tested for TSS and

ammonia. Nitrogen-ammonia levels did not exceed 0.17 mg/l and remained fairly constant, ranging from 0.05 to 0.17 mg/l throughout the year. Total suspended solids ranged from 4 to 13 mg/l. Biological oxygen demand (BOD) ranged between 1.0 and 7.0 mg/l (Fig. 1). Total suspended solids ranged from 191 to 696 lbs./day with an average of 235 lbs./day being produced (Fig. 2). The mean monthly pH level was 7.5 with a range of 7.2 to 7.6 (Fig. 3). Mean monthly water usage in million of gallons per day was 6.34, with a range of 5.75 to 6.92 (Fig.4).

TABLE 5. --- NPDES Effluent Discharge Limitations For Cleghorn Springs Fish Hatchery.

EFFLUENT CHARACTERISTIC		30-DAY AVERAGE	DAILY MAXIMUM
TOTAL SUSPENDED SOLIDS (LBS/DAY)		372	558
TOTAL SUSPENDED SOLIDS (mg/L)		N/A	10
BOD	5 DAY (mg/L)	N/A	10
pH		>6.6	<8.3

QUALITY CONTROL

In an effort to assess hatchery performance from year to year several charts have been created to give a quick graphical measure of production output. Parameters chosen to measure performance were size of the fish when stocked and stocking time. Oversize fish increase the cost of a program and undersize fish don't fulfill angler expectations. In either case, modifications need to be made to hatchery programming to achieve target size. Time of stocking was compared to the scheduled stocking date. Stocking book dates are designed to spread the stockings throughout spring, summer, and fall months to ensure excellent fishing opportunities throughout the year. Large deviations from the scheduled stocking dates indicate that during certain weeks or months of the year fishing may not be as good as possible, especially in stream sections receiving a lot of pressure and where natural trout reproduction may not occur.

Rainbow trout catchables averaged 3.7 fish/kg., slightly larger than the requested 4.1 fish/kg programmed size (Figure 5). Adjustments in future programming can be made to decrease the average size of the catchables. Figure 6 shows the size at stocking of the 15" fish. All stockings were larger than the requested 1.6/kg fish. The large fish program is still new and efforts continue to reduce the average size while maintaining fin quality. Brown trout production will be transferred to McNenny State Fish Hatchery in the 2000 year stocking schedule due to past problems with furunculosis and slow growth rates at Cleghorn Springs. Nearly all brown trout stockings were smaller than the requested 4.1/kg even though the brown trout were on station for longer periods of time than rainbow trout (Figure 7). To determine how close actual stocking times were to scheduled times, a graph of ± 5 days from the stocking schedule was created. Overall, Cleghorn was within + or - five days of the stocking schedule 34% of the time. Weather conditions, personnel shortages, and mechanical failures are responsible for much of this variance. However, greater efforts will be made in the 1999 stocking season to achieve a higher percentage of stocking time success in each body of water.

APPENDIX A.

LOT HISTORIES

Lot histories provide an archive of production data that is useful for long range production and cost analysis. This information shows the cost relationships among sizes of fish as well as other production costs that may vary by year or program. Since fish cost is a function of its rearing time in the hatchery, there is an averaging effect for a given lot of fish when stocked over an extended period of time. This would be most evident for catchables and broodstock. The information included for each lot starts with the species. The species code follows the Federal fish species acronym list. The first group of letters identifies the specie(s), after the dash if applicable, is a single letter that identifies the strain, followed by the year obtained and finally a letter that designates either fall (F) or spring (S) spawned. A list of strains follows.

A.....	Arlee
E.....	Eagle Lake
G.....	Growth
K.....	Kamloops
L.....	Fish Lake
M.....	McConaughy
O.....	Oahe
S.....	Shasta

Species	Brown Trout	Brown Trout	Brown Trout	Rainbow Trout	Rainbow Trout	Rainbow Trout	Rainbow Trout	Rainbow Trout
Lot	BNTS95F	BNT-S96F	BNT-S97F	RBT-K96F	RBT-G93F	RBT-K93F	RBT-K95F	RBT-A97S
Source	Dubois	Dubois	Daniel	Cleghorn	Cleghorn	Cleghorn	Cleghorn	Ennis
Date Received	1-Dec-95	12/15/96	11/13/97	10/96	11/93	9/15/93	9/95	1/97
# @ Initial Feeding	49000.00	78000	40000	50000	50000	189893	266500	76000
Wt. @ Initial Feeding	6.00	36.00	4.82	6.02	6.02	23.00	32.00	9.16
Date of Initial feeding	12/22/1995	01/15/97	12/97	12/96	1/8/94	10/15/93	10/95	2/97
# On Hand 1/1/97	24886	78000	0	51163	115	850	1844	0
Wt. 1/1/97	1224	36	0	243	115	2600	154	0
# Stocked 1997	16600	0	0	45000	115	820	1095	69900
Wt. Stocked 1997 (Kg)	2863	0	0	4978	261	3,027	452	103
Feed fed 1997 (Kg)	2919	1428	25	4396	261	584	1605	95
Wt. Gained 1997 (Kg)	1639	1210	7	4735	146	427	664	94
Conversion	1.78	1.18	3.57	0.93	1.79	1.37	2.42	1.01
# On Hand 12/31/97	0	22651	28000	0	0	0	740	0
Wt. On Hand 12/31/97	0.00	1246.00	7.00	0.00	0.00	0.00	366.00	0.00
Production Costs								
Labor	\$2,353	\$1,737	\$10	\$6,798	\$210	\$613	\$954	\$135
Utilities	\$2,014	\$1,487	\$9	\$5,817	\$179	\$525	\$816	\$116
Fish Health	\$267	\$197	\$1	\$770	\$24	\$70	\$108	\$15
Feed	\$1,898	\$928	\$16	\$2,858	\$170	\$380	\$1,043	\$62
Spawning Costs	\$85	\$63	\$0	\$246	\$8	\$22	\$35	\$5
Overhead	\$6,093	\$4,498	\$26	\$17,603	\$543	\$1,588	\$2,470	\$350
C.Y. 97 Prod. Net Cost	\$12,709	\$8,910	\$62	\$34,092	\$1,133	\$3,198	\$5,426	\$683
Cost/Kg C.Y. 97	\$7.75	\$7.36	\$8.92	\$7.20	\$7.76	\$7.49	\$8.17	\$7.25
C.Y. 96 Accrued Cost	\$9,254	\$240	\$0	\$1,944	\$805	\$15,600	\$954	\$0
C.Y. 97 Accrued Cost	\$ 21,963	\$ 9,415	\$ 62	\$ 36,036	\$ 1,938	\$ 18,798	\$ 3,943	\$ 683
Total Accrued Production	2863	1246	7	4978	261	3027	818	94
Cost per kilogram	\$7.67	\$7.56	\$8.92	\$7.24	\$7.42	\$6.21	\$4.82	\$7.25

Species	Rainbow Trout	Rainbow Trout	Rainbow Trout	Rainbow Trout	Rainbow Trout	Rainbow Trout	Rainbow Trout	Rainbow Trout
Lot	RBT-K96F	RBT-K97F	RBT-K97F	RBT-KG97F	RBT-M95S	RBT-M96S	RBT-R97F	RBT-S96S
Source	Cleghorn	Cleghorn	Cleghorn	Cleghorn	Ennis	Ennis	Ennis	Ennis
Date Received	9/15/96	8/97-10/97	10/97	10/97	01/30/95	01/30/96	08/06/97	01/96
# @ Initial Feeding	110000	800	78000	85000	56251	56251	75000	100000
Wt. @ Initial Feeding	13.25	0.10	9.40	10.24	7.00	7.00	9.04	12.05
Date of Initial feeding	11/01/96	11/97	12/97	11/97	2/95	2/96	10/97	02/96
# On Hand 1/1/98	25000	0	0	0	1800	16597	0	1900
Wt. 1/1/97	7	0	0	0	500	600	0	79
# Stocked 1998	10795	0	0	0	1792	16572	0	0
Wt. Stocked 1998 (Kg)	129	0	0	0	1,625	1,670	0	0
Feed fed 1998 (Kg)	2675	0	76	0	1937	899	110	800
Wt. Gained 1998 (Kg)	2628	1	35	81	1125	1070	228	784
Conversion	1.02	0.00	2.17	0.00	1.72	0.84	0.48	1.02
# On Hand 12/31/98	16381	800	73542	81000	0	0	39000	1900
Wt. On Hand 12/31/98	2506.00	1.00	35.02	81.00	0.00	0.00	228.07	863.64
Production Costs								
Labor	\$3,773	\$1	\$50	\$116	\$1,616	\$1,536	\$327	\$1,126
Utilities	\$3,228	\$1	\$43	\$100	\$1,383	\$1,315	\$280	\$964
Fish Health	\$427	\$0	\$6	\$13	\$183	\$174	\$37	\$128
Feed	\$1,739	\$0	\$49	\$0	\$1,259	\$584	\$72	\$520
Spawning Costs	\$137	\$0	\$2	\$4	\$59	\$56	\$12	\$41
Overhead	\$9,769	\$4	\$130	\$301	\$4,184	\$3,978	\$848	\$2,916
C.Y. 98 Prod. Net Cost	\$19,073	\$7	\$280	\$534	\$8,683	\$7,643	\$1,576	\$5,695
Cost/Kg C.Y. 97	\$7.26	\$6.60	\$8.01	\$6.60	\$7.72	\$7.14	\$6.91	\$7.26
C.Y. 97 Accrued Cost	\$406	\$0	\$0	\$0	\$3,400	\$1,693	\$0	\$475
C.Y. 98 Accrued Cost	\$ 18,595	\$ 7	\$ 280	\$ 534	\$ 12,083	\$ 9,336	\$ 1,576	\$ 6,745
Total Accrued Production	2635	1	35	81	1625	1670	228	864
Cost per kilogram	\$7.06	\$6.60	\$8.01	\$6.60	\$7.43	\$5.59	\$6.91	\$7.81

Species	Rainbow Trout	Rainbow Trout	Rainbow Trout	Rainbow Trout
Lot	RBT-S96F	RBTM96S	RBTG96F	RBT-S96S
Source	Ennis	Ennis	Cleghorn	Ennis
Date Received	12/18/96	01/30/96	9/96	01/96
# @ Initial Feeding	110000	56251	80000	100000
Wt. @ Initial Feeding	13.25	7.00	9.60	12.05
Date of Initial feeding		2/96	11/96	02/96
# On Hand 1/1/98	99802	5887	78630	94000
Wt. 1/1/98	12.9	74	160	2110
# Stocked 1998	2725	4000	70000	82800
Wt. Stocked 1998 (Kg)	148	498	349	17,237
Feed fed 1998 (Kg)	6323	767	211	16563
Wt. Gained 1998 (Kg)	6058	721	189	15127
Conversion	1.04	1.06	1.12	1.09
# On Hand 12/31/98	52252	1155	0	0
Wt. On Hand 12/31/98	5923.00	297.00	0.00	0.00
Production Costs				
Labor	\$8,697	\$1,035	\$271	\$21,719
Utilities	\$7,442	\$886	\$232	\$18,584
Fish Health	\$986	\$117	\$31	\$2,461
Feed	\$4,111	\$499	\$137	\$10,768
Spawning Costs	\$315	\$37	\$10	\$787
Overhead	\$22,521	\$2,680	\$702	\$56,238
C.Y. 97 Prod. Net Cost	\$44,072	\$5,254	\$1,383	\$110,556
Cost/Kg C.Y. 98	\$7.28	\$7.29	\$7.32	\$7.31
C.Y. 97 Accrued Cost	\$48	\$285	\$270	\$14,181
C.Y. 98 Accrued Cost	\$ 43,138	\$ 2,450	\$ 1,653	\$124,737
Total Accrued Production	6071	795	349	17237
Cost per kilogram	\$7.11	\$3.08	\$4.74	\$7.24

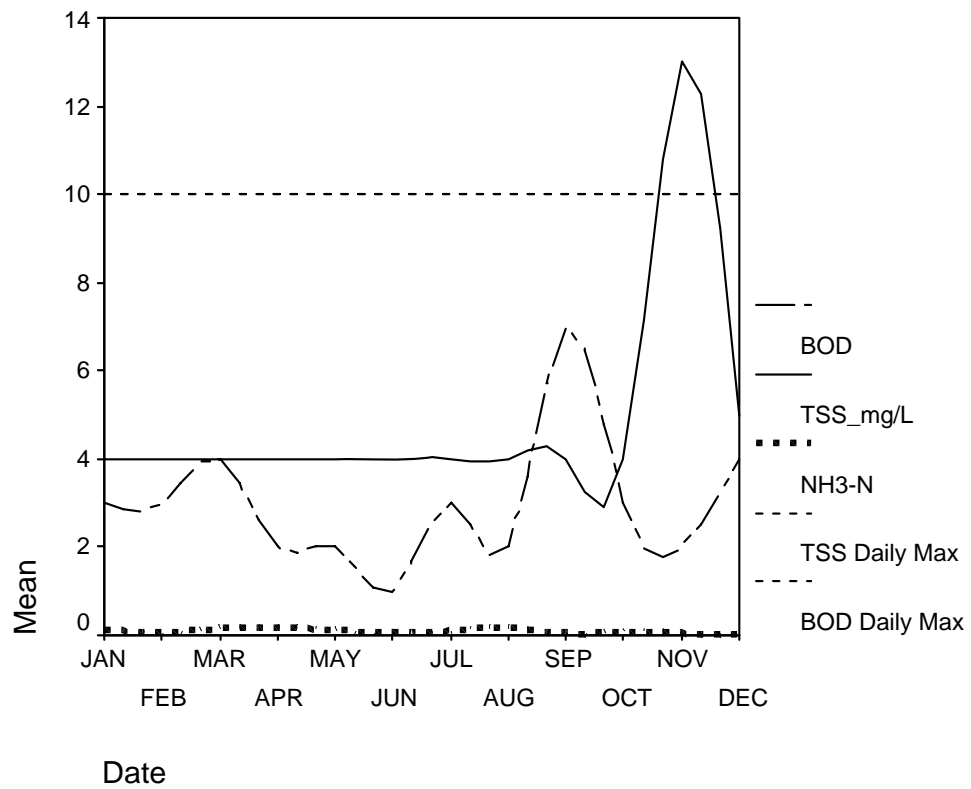


Figure 1. Mean monthly water quality samples taken from the flume (hatchery effluent) showing nitrogen-ammonia (NH₃-N), total suspended solid (TSS), and biological oxygen demand (BOD). Also shown are the daily maximum allowable limits for TSS and BOD.

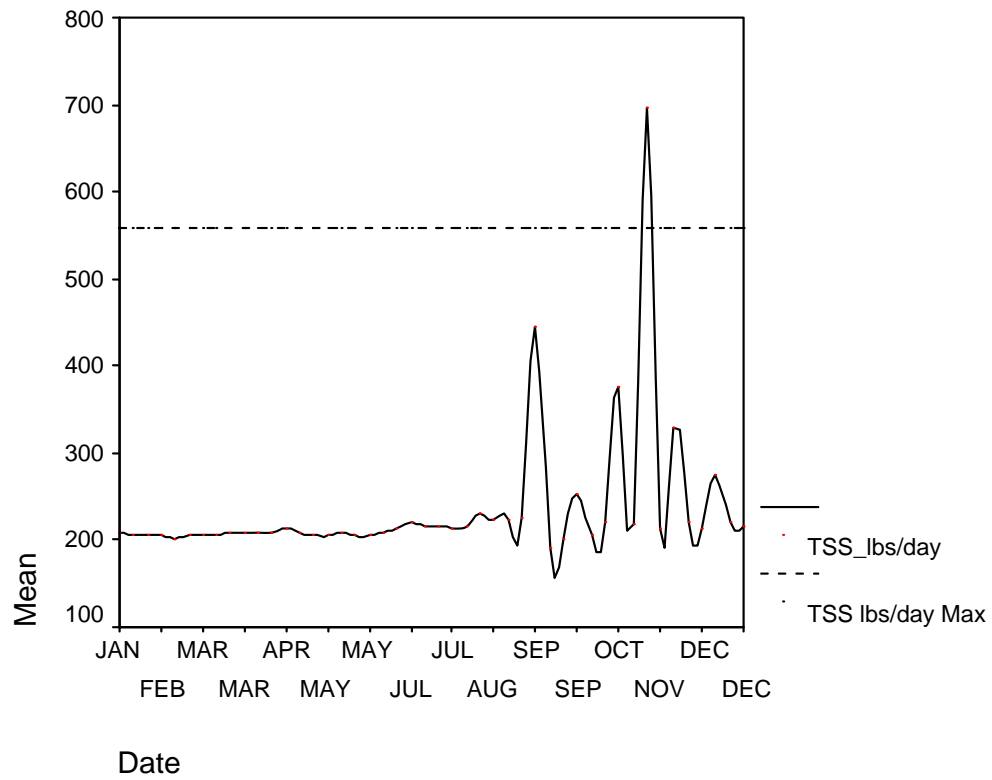


Figure 2. Mean monthly calculated total suspended solids from hatchery effluent and daily maximum limit for calculated total suspended solids.

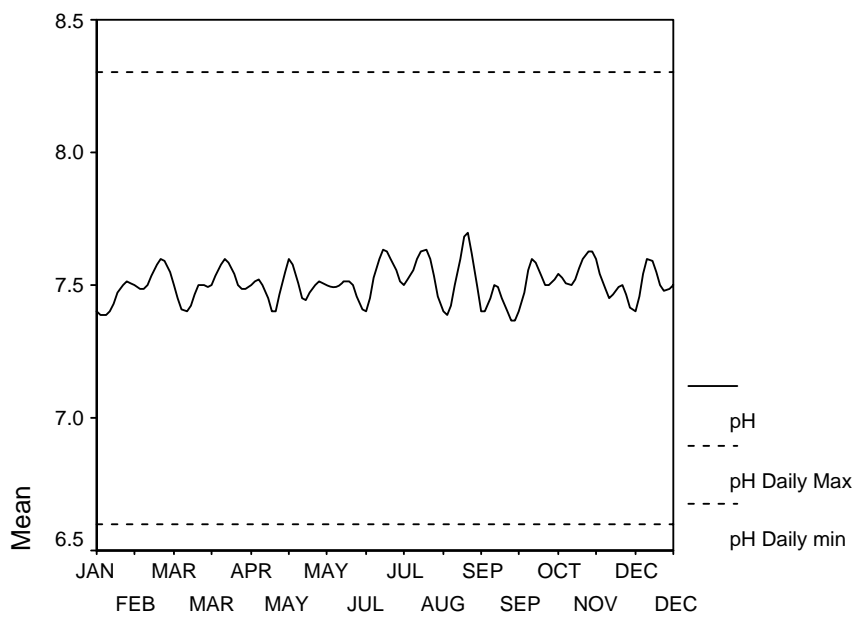


Figure 3. Mean monthly pH levels from hatchery effluent with daily minimum and maximum levels.

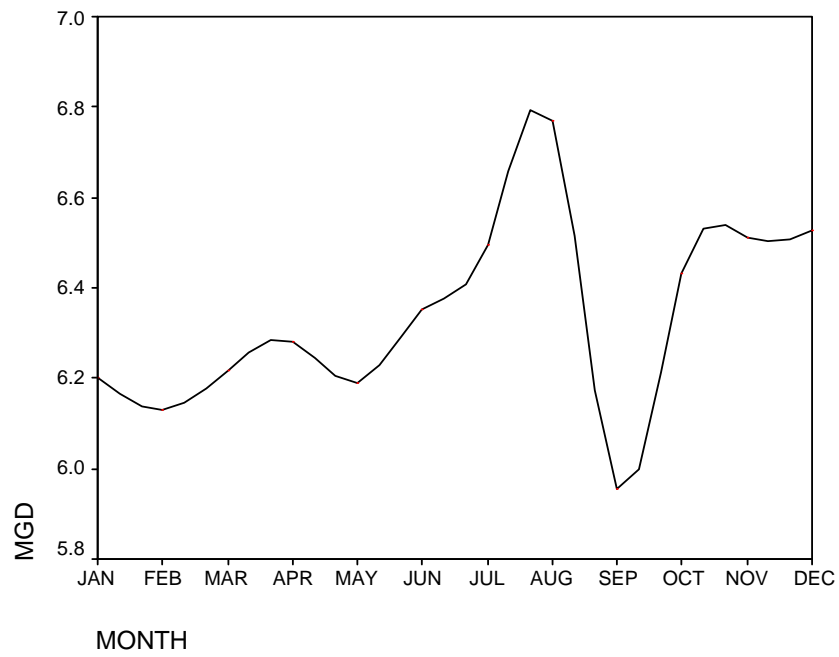


Figure 4. Mean monthly water usage in millions of gallons/day.

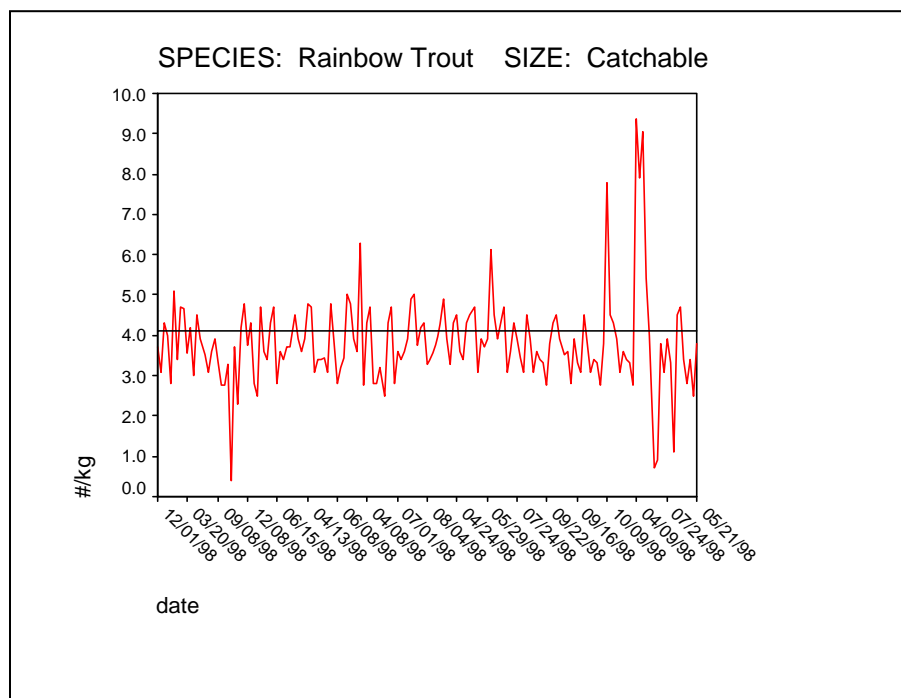


Figure 5. Actual size in #/kg of fish at time of stocking. The horizontal line shows the requested size of 4.1/kg.

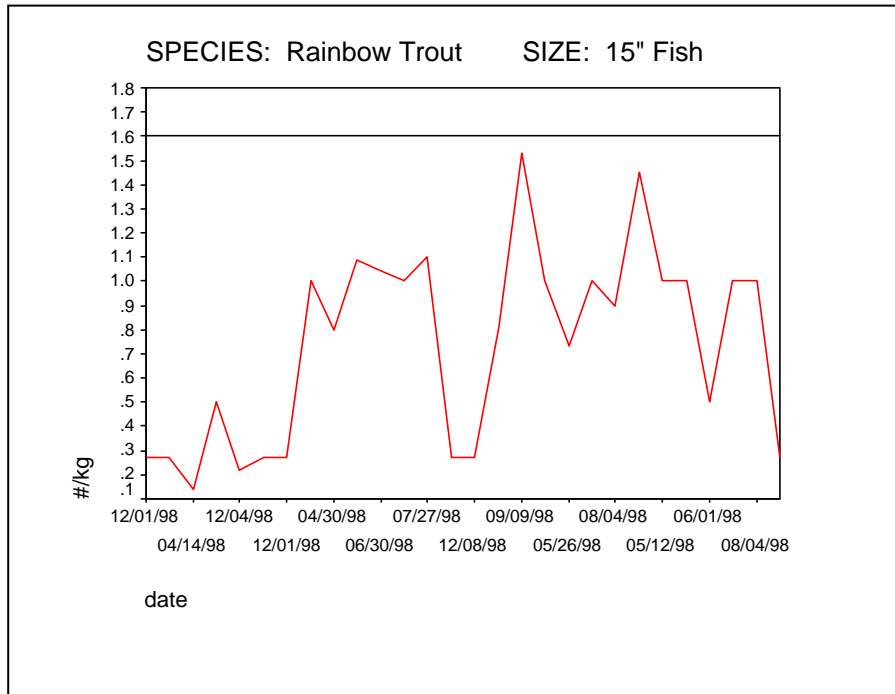


Figure 6. Size of 15" fish at time of stocking expresses as #/kg. The horizontal line shows the requested size of 1.6/kg.

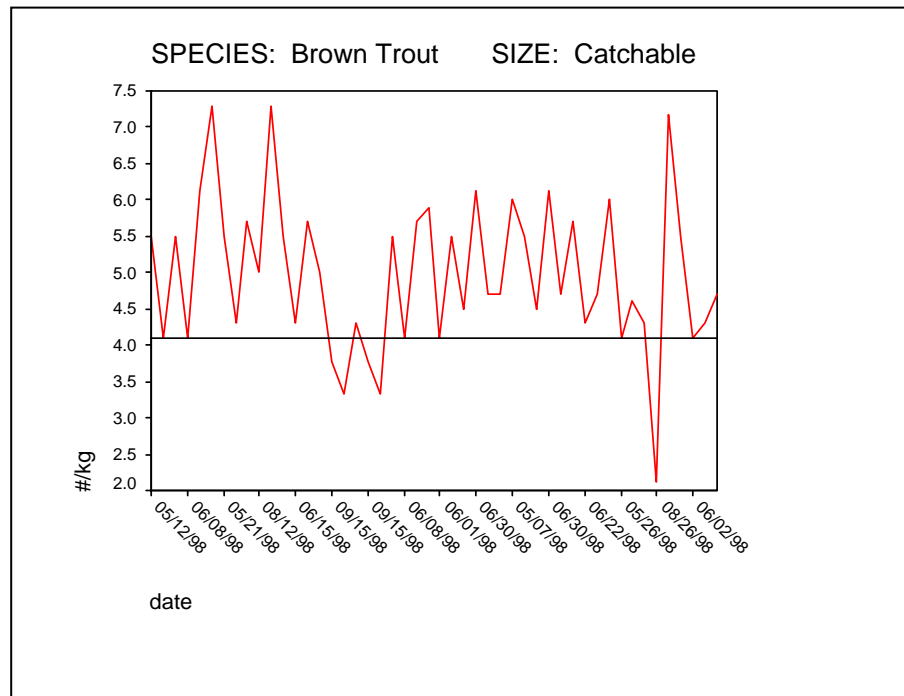


Figure 7. Size of brown trout expressed as #/kg at time of stocking. The horizontal line shows the requested size of 4.1/kg.

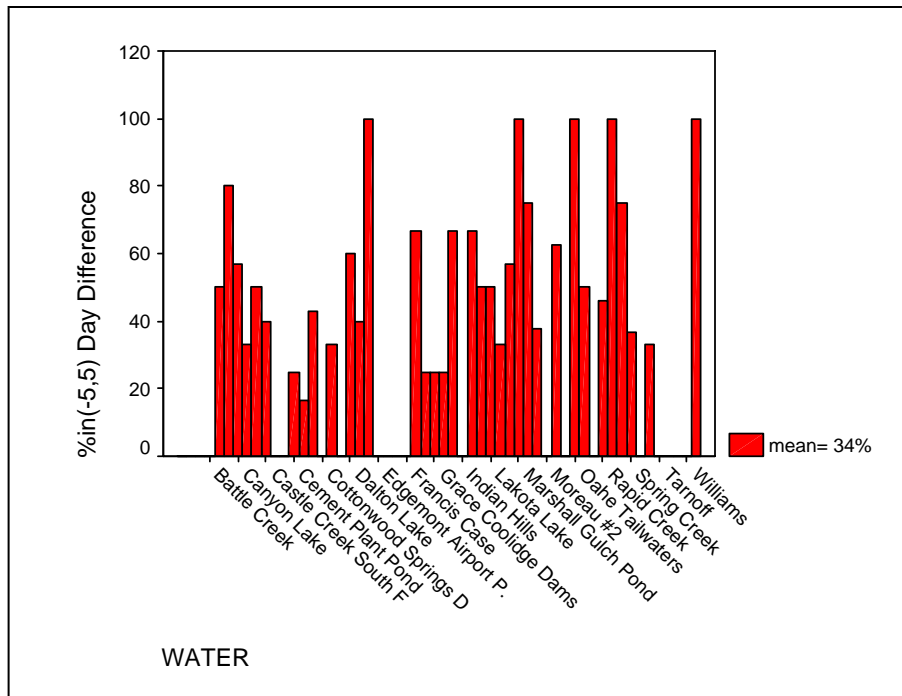


Figure 8. Percentage of time actual stocking was completed within + or - 5 days of scheduled stocking time for each body of water.

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LOCATION AND HISTORY

Cleghorn Springs Hatchery, located at the western edge of Rapid City on a 5.4A. Site bordered on the north side by Route 44 and on the south side by Rapid Creek has been in operation since 1928. The site was selected for and named after the large spring that drew homesteaders here in 1889. Hatchery operations housed at another site downstream were moved in after completion of the first facilities in 1928. A single story stone and brick building on the east end of the site served as the incubation, fry rearing and administrative facilities. Twelve earthen ponds fed by gravity surface spring water were used to rear fish to 6" stocking size. Renovations in circa 1934 created 29 smaller stone walled ponds with 7 earth ponds remaining.

The hatchery remained relatively unchanged until the devastating flood of 1972, which destroyed the original building and all of the ponds. Fish stocking operations were maintained by obtaining fish from the United States Fish and Wildlife Service, McNenny Hatchery, neighboring states, and purchases during 1973. A new hatchery building and raceway complex was designed and constructed. Concrete raceways replaced the ponds while the surface spring intakes were replaced with an underground infiltration gallery and a new flood proof pre-cast concrete building completed the re-construction. In 1982, a recirculated water system was installed to increase utilization of the raceways which were originally oversized in anticipation of developing additional water. Although providing increased flow to the raceways; high dissolved nitrogen levels, low oxygen levels and suspended solids in the re-use water hampered production. The recirculation system was abandoned and a nitrogen degassing/oxygen supplementation system was added in the fall of 1988 resulting in improved production capabilities. Five 10' diameter circular tanks were installed indoors in 1995 to reduce labor demands and improve trout quality.

PRODUCTION UNITS

- 160 Heath incubator trays in 8 stacked units
- 7 Eagar upwelling incubator
- 21 Heath Techna fiberglass start tanks 14.5' x 1.75' x 0.75'
- 5 Gemini 10' diameter x 4' deep circular fiberglass tanks
- 10 Concrete raceways 500' x 8' x 2' dividable into 4 ponds each
- 2 Concrete raceways 200' x 16' x 2' dividable into 4 ponds each

WATER PRODUCTION AND TREATMENT SYSTEMS

Spring water collected 4.5 m. underground flows by gravity pipeline to a 67 Kw vertical axis turbine pump, which pumps it to two degassing towers. The main tower with four 1 m. o.d. x 2 m. High degassing columns supplies water by gravity to the head of the raceways at the west end of the raceways. The smaller tower, with one column, supplies water to the hatchery building. Degassing and re-oxygenation are accomplished in the sealed aluminum columns filled with 3.8 cm (1.5") Flexi-Ring diffusers. Three Airsep model AS 250 pressure swing absorption generators in parallel provide 100 liters /min of oxygen with 100% back up capacity.

Two 30 Kw Sullaire rotary screw air compressors supply air to the oxygen generators through a 0.6 Kw (3/4hp) UltraAir dryer and a 1500 l pressure tank. An emergency back-up system of twenty “K” size oxygen cylinders with a capacity 150 cubic meters (5000 CU.FT.)@ 14 Mpascals (2000 psi) supplies emergency oxygen when system pressure drops below normal (45psi) operating pressure. This bank is kept filled by a Haskell pneumatic booster pump. Oxygen is also added to the 8 most heavily loaded raceways with portable oxygen contactors.

The hatchery discharge is permitted and monitored under National Pollution Discharge Elimination System (NPDES) permit # SD 0000060. Wastewater is treated by gravity sedimentation in two parallel 9m x 30m x 1m. (30’x100’x3’), settling basins prior to discharge to Rapid Creek. Settling basin sludge is recycled at the Rapid City composting site.

HATCHERY STAFFING

- Hatchery Manager
- Assistant Hatchery Manager
- Biologist
- 1.8-Conservation Technicians
- 1-2 Work release inmates

PRODUCTION SUMMARY

Total number, weight, and operational cost for fish stocked during calendar year 1999 at Cleghorn Springs are summarized in Table 1. Costs are based on direct labor, feed, production overhead, stocking, and site administrative overhead costs. Production overhead includes water pumping, degassing, oxygenation, and facility and grounds maintenance costs. These costs are prorated by unit weight to arrive at total production cost of a given fish lot. They do not include capital costs associated with the hatchery nor do they include administrative overhead above the site level. Unit cost may vary slightly among lots, but in general terms the cost to rear a fish of a given weight/ age is constant.

Table 1. Calendar Year 1999 Stocking summary by program

Program	species	Size	Number	Weight
Large Lakes and Reservoirs				
	RBT			
	CAT		42746	4830
	Program Subtotal		42746	4830
Missouri River				
	BNT			
	FNG		6834	34
	RBT			
	CAT		18729	2646
	FNG		221352	3372
	Program Subtotal		246915	6052
Small Lakes and Ponds				
	BNT			
	CAT		373	58
	RBT			
	ADT		2377	3626
	CAT		79072	19558
	FNG		93866	1105
	Program Subtotal		175687	24347
Streams				
	BNT			
	CAT		10430	2141
	RBT			
	ADT		3279	3849
	CAT		6906	1868
	Program Subtotal		20616	7859
Grand Total			485963	43089

Table 2. Calendar Year 1999 Operating Expenditures, Cleghorn Springs Hatchery.

Salaries and Benefits	\$184,921
Travel	\$2,254
Contractual Services	\$103,078
Supplies and Materials	\$69,939
Capital	\$4,501
Total	\$364,693

Total accrued cost for each lot of fish is listed in the lot history (appendix 1). Monthly expenditure records are summarized by calendar year to obtain the annual costs associated with each lot, which is added to the accrued cost in the lot history. Total annual expenditures (Table 2.) reflect the cost of the total weight of fish produced during the year regardless of whether or not they were stocked or held over. Calendar year expenditures are similar to, but not equal to, fiscal budget year expenditures. This results from posting dates and fund balance transfers occurring at the end of fiscal year accounting cycles. The average cost per kilogram of production multiplied by the kilograms of production for a twelve-month period gives a figure close to an average fiscal year operational budget. Table 3 illustrates how the calendar year labor was distributed. This calendar year workers were available from the Community Alternatives work release program in Rapid City. Nearly 3,000 man hours were used that are not tracked in our accounting system. The grounds and building maintenance was almost entirely performed with these services and they are not reflected in Table 3.

Mature brood fish are fed a maintenance diet to cut growth while maintaining condition. Younger brood fish are fed at production rates until age 2. Spawning operations were conducted from late August through October. Fish were sorted for ripeness weekly and ripe fish were spawned the day after sorting. Females three years and older were air spawned; while 2 year olds, which are easy to handle, were hand spawned. Table 4 summarizes the 1999 operations. Total egg production was 1,321,842 eggs. Just over 450,000 were used to meet production needs at Cleghorn, 313,000 were shipped to McNenny and the balance were discarded (\$15,000 worth).

Table 3. ---Labor Distribution by Task Calendar Year 1999

TROUT CULTURE	54.49%
FISH DISTRIBUTION	7.83%
FISH HEALTH MANAGEMENT	0.40%
SPAWNING AND EGG COSTS	1.57%
ADMINISTRATION	28.68%
EQUIPMENT MAINTENANCE	1.70%
BUILDING AND GROUNDS MAINTENANCE	3.16%
OTHER	2.17%

Table 4. Summary of 1999 spawning showing number of eggs produced at Cleghorn, number transferred to McNenny State Fish Hatchery and number received from other sources by date and strain.

Year	1999	Total Eggs:	1321842		
Strain		FCS-095F	Total	111395.	
	Source	Strain	Total Eggs for Day	Transferred to McNenny	
09/21/1999	Cleghorn	FCS-095F	13120	0	
09/28/1999	Cleghorn	FCS-095F	39156	0	
10/05/1999	Cleghorn	FCS-095F	39983	0	
10/13/1999	Cleghorn	FCS-095F	19136	0	
Strain		RBT-C95F	Total	444702	
	Source	Strain	Total Eggs for Day	Transferred to McNenny	
08/31/1999	Cleghorn	RBT-C95F	23702	0	
09/08/1999	Cleghorn	RBT-C95F	54357	10246	
09/15/1999	Cleghorn	RBT-C95F	42356	0	
09/21/1999	Cleghorn	RBT-C95F	58190	0	
09/28/1999	Cleghorn	RBT-C95F	62108	62108	
10/05/1999	Cleghorn	RBT-C95F	135486	135486	
10/13/1999	Cleghorn	RBT-C95F	68504	0	
Strain		RBT-C97F	Total	765743	
	Source	Strain	Total Eggs for Day	Transferred to McNenny	
08/31/1999	Cleghorn	RBT-C97F	6667	0	
09/08/1999	Cleghorn	RBT-C97F	15909	0	
09/15/1999	Cleghorn	RBT-C97F	11932	0	
09/21/1999	Cleghorn	RBT-C97F	43567	0	
09/28/1999	Cleghorn	RBT-C97F	42560	42560	
10/05/1999	Cleghorn	RBT-C97F	63840	63840	
10/13/1999	Cleghorn	RBT-C97F	115142	0	
10/21/1999	Cleghorn	RBT-C97F	101919	0	
11/02/1999	Cleghorn	RBT-C97F	220913	0	
11/16/1999	Cleghorn	RBT-C97F	143296	0	

SUPPLY WATER QUALITY AND QUANTITY

Cleghorn Springs supplies an average 6 million gallons per day to the hatchery. Flow rates fluctuate, annually, seasonally, and with competitive demand from the Rapid City Jackson Springs pumping station. No significant fluctuations have occurred in the chemical nature of the water supply since 1973. Water levels were fairly stable this year. The hatchery water rights were reviewed and a proposal was sent to Pierre suggesting they be increased from 6.18 to 10.0 cfs to match the amount of water that is currently being used.

FISH CULTURE ACTIVITIES

The large rainbow rainbow trout program continues to be very popular. No significant problems were encountered getting them up to size. Floating extruded pellet diets with canthaxanthin, a pigment that enhances skin and flesh color, continues to produce pleasing external and internal color in the rainbow trout. Some fish losses occurred from low oxygen problems associated with the low inflow head on the raceways. Head screens with small holes restrict the flow if they get any fouling on them and divert the water to other raceways resulting in low flow and oxygen in the restricted raceway.

FISH HEALTH

Cleghorn Springs Fish Hatchery continues to remain disease free. Brown trout production has been shifted to McNenny State Fish Hatchery where production in earthen ponds offers a better rearing environment than our current raceways. The last lot of brown trout will be reared in 1999-2000. Brown trout production will be evaluated for future production when better rearing conditions are available at Cleghorn Springs.

RESEARCH

Chinook salmon

Due to concerns about the success of return of salmon to Whitlocks Bay in Oahe, hatchery staff experimentally spawned the 95 year class still remaining on the Cleghorn hatchery. A total of 111,396 salmon eggs were spawned from 4 year old Chinook salmon reared at the hatchery from eggs in 1995. Eggs were obtained in the fall of 1995 from Lake Oahe, South Dakota. Most of the chinook fingerlings reared at the hatchery were stocked back into Lake Oahe with the exception of 1,000 chinook fingerlings which were retained at the hatchery for educational and display purposes.

Eighty-one fish were spawned from 9/21/99 to 10/13/99. On 9/21/99 12 females were spawned and incubated individually to determine variability between females. Each female was fertilized with 1 male. Fish spawned on 9/28, 10/5, and 10/13/99 were pooled together. Pooled fish had 3 females per egg tray. The eggs from the 3 females were fertilized with the milt from 3 males.

Over 13,000 eggs were collected from 12 females on 9/21/99. Eggs per female ranged from 803 to 1714 eggs/female with the average being 1,136 eggs per female. Egg size ranged from 4.65 to 8.93 eggs/ml with an average of 6.04 eggs/ml. Survival ranged from 0 to 98 % to the eyed egg stage with an average survival of 83%. The one tray, which had 0 % survival, was most likely the result of use of an infertile male. Removing the one bad tray produces a range of

71 to 98 % with the average being 91% survival to eye. Survival to swim-up from the eyed egg stage was 90 %.

Egg size was similar for all pooled fish, ranging from 5.80 to 6.17 eggs/ml. The number of eggs per female was also similar from the pooled eggs on the three dates taken, numbers being 1151, 1142, and 1125. Egg survival to eye was lowest on 9/28/99 ($\mu = 69.9\%$), while on 10/5/99 and 10/13/99 mean survival to eye was 92.1 and 88.9 % respectively. Low survival of the eggs on 9/28 was likely a result of the egg-picking machine. On all other dates eggs were handpicked due to low numbers of bad eggs. Over 80,000 chinook eggs were transferred to Montana Fish, Wildlife and Parks.

Egg Jars vs. Heath Tray incubators

Hatching jars for trout incubation have been used prior to 1960 in hatchery facilities around the world with success however they have never been used at Cleghorn Springs prior to 1999. Heath tray incubators work well, however formalin is required to prevent fungal growth from overtaking the eggs. The constant motion of the eggs in the jar may prevent fungal adhesion and reduce or eliminate usage of formalin. Seven trials with jars without formalin versus standard tray incubators with formalin in were performed. In nearly all tests jars outperformed trays or were similar (Table). Further experimentation will occur during the 2000-spawning season.

Table 5. Results of jar incubator vs. heath tray incubators for 1999. All jar Incubators start with the letter J

Jar Group Date					
	Strain	Incubator	Total	Eggs after Picking	Survival to Eye
1	09/08/1999				
	RBT-C95F	J3	14999	14227	94.85
	RBT-C95F	J2	14999	13659.75	91.07
	RBT-C95F	8	24358	22435	92.11
2	09/21/1999				
	RBT-C95F	J1	20043	11926.25	59.50
	RBT-C95F	J4	20043	12159	60.66
	RBT-C95F	9	18103	11637.9	64.29
3	10/13/1999				
	RBT-C95F	2	28346	18604.8	65.63
	RBT-C95F	J3	20079	11628	57.91
	RBT-C95F	J2	20079	13016.85	64.83
4	10/13/1999				
	RBT-C97F	3	31691	21000	66.27
	RBT-C97F	J5	41198	29066.125	70.55
	RBT-C97F	J6	42254	32608.5	77.17
5	10/21/1999				
	RBT-C97F	J4	40383	17068.425	42.27
	RBT-C97F	7	21153	9374.85	44.32
	RBT-C97F	J1	40383	12930.625	32.02
6	11/02/1999				
	RBT-C97F	J3	49320	23000	46.63
	RBT-C97F	4	61650	32746.85	53.12
	RBT-C97F	6	60623	31072.05	51.25
	RBT-C97F	J2	49320	26715	54.17
7	11/16/1999				
	RBT-C97F	8	20151	0	0.00
	RBT-C97F	J4	51497	12857.4	24.97
	RBT-C97F	J1	51497	12857.4	24.97
	RBT-C97F	1	20151	0	0.00

The second year for the Sweeney feeders has revealed some minor problems with feed sizes, wind, and feed distribution down the raceways. We will continue to evaluate these units and look at corrective measures.

EFFLUENT WATER QUALITY

Cleghorn Springs Trout Hatchery operates under NPDES permit SD-0000060. Discharge limits are summarized in Table 5. Careful production programming and operating keep water quality within the permit limits set by the Environmental Protection Agency. Water is sampled and analyzed weekly for TSS (total suspended solids), BOD (biological oxygen demand), pH, and monthly for ammonia. A quarterly sample taken during pond cleaning is tested for TSS and ammonia. Nitrogen-ammonia levels did not exceed 0.16 mg/l and remained fairly constant ranging from 0.05 to 0.16 mg/l throughout the year. Total suspended solids ranged from 1 to 9 mg/l. Biological oxygen demand (BOD) ranged between 1.0 and 8.0 mg/l (Fig. 1). Total suspended solids ranged from 54 to 462 lbs/day with an average of 230 lbs./day being produced (Fig. 2). The mean monthly pH level was 7.5 with a range of 7.2 to 7.6 (Fig. 3). Mean monthly water usage in million of gallons per day was 6.75 with a range of 6.06 to 8.29 (Fig.4)

Table 6. --- NPDES Effluent Discharge Limitations For Cleghorn Springs Fish Hatchery.

EFFLUENT CHARACTERISTIC	30-DAY AVERAGE	DAILY MAXIMUM
TOTAL SUSPENDED SOLIDS (LBS/DAY)	372	558
TOTAL SUSPENDED SOLIDS (mg/L)	N/A	10
BOD 5 DAY (mg/L)	N/A	10
pH	>6.6	<8.3

APPENDIX A.

LOT HISTORIES

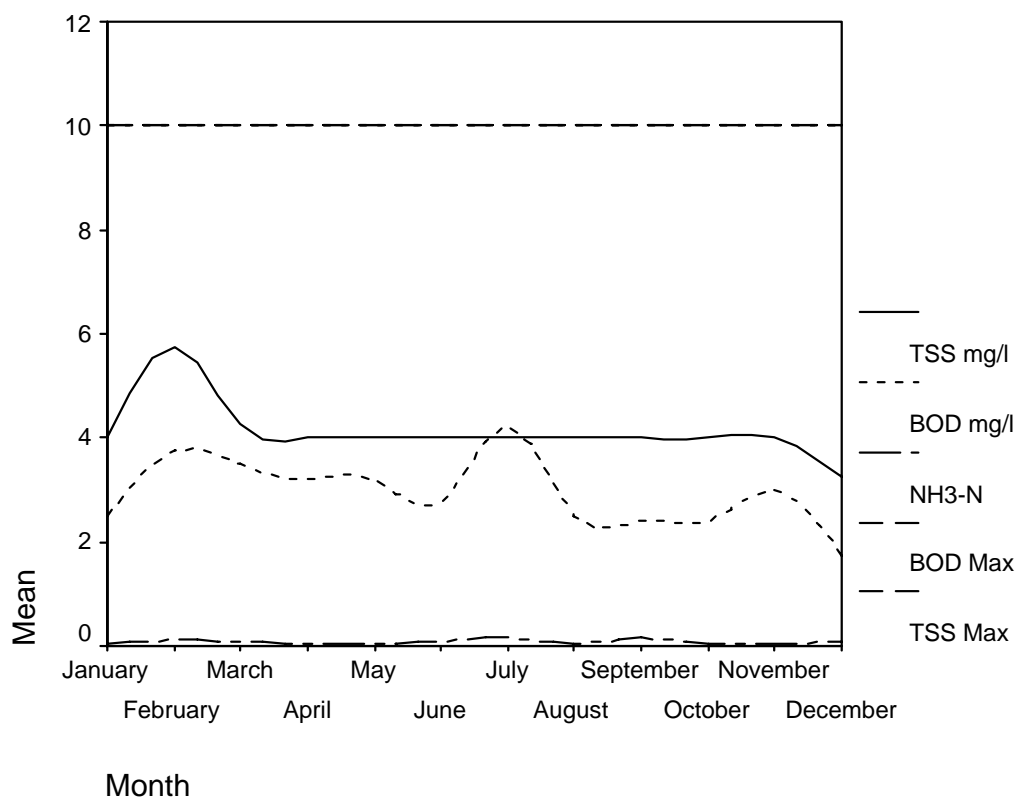
Lot histories provide an archive of production data that is useful for long range production and cost analysis. This information shows the cost relationships among sizes of fish as well as other production costs that may vary by year or program. Since fish cost is a function of its rearing time in the hatchery, there is an averaging effect for a given lot of fish when stocked over an extended period of time. This would be most evident for catchables and broodstock. The information included for each lot starts with the species. The species code follows the Federal fish species acronym list. The first group of letters identifies the specie(s), after the dash if applicable, is a single letter that identifies the strain, followed by the year obtained and finally a letter that designates either fall (F) or spring (S) spawned. A list of strains follows.

A.....	Arlee
E.....	Eagle Lake
G.....	Growth
K.....	Kamloops
L.....	Fish Lake
M.....	McConaughy
O.....	Oahe
S.....	Shasta

Species	Brown trout	Brown trout	Rainbow Trout	Rainbow Trout	Rainbow Trout	Rainbow Trout	Rainbow Trout
Lot	BNT-S97F	BNT-P98F	rbtc98f	RBT-C98FBR	RBT-C99F	RBT-C95F	RBT-C96F
Source	Daniel	Saratoga	Cleghorn	Cleghorn	Cleghorn	Cleghorn	Cleghorn
Date Received	11/13/97	11/3/98	9/98	8/98-10/98	8/99-11/99	9/95	9/15/96
# @ Initial Feeding	40,000	20,000	375,000	400	110,000	266,500	110,000
Wt. @ Initial Feeding	4.82	2.41	45.18	0.05	13.25	32.00	13.25
Date of Initial feeding	12/97	12/98	11/98	11/98	11/99	10/95	11/01/96
# On Hand 1/1/99	8,584	18,000	328,702	389	-	285	1,540
Wt. 1/1/99	630	14	763	0.9725	0	175	1171
# Stocked 1999	9,272	7,432	289,267	n/a	-	215	1,298
Wt. Stocked 1999 (Kg)	1979	102	9,108	n/a	0	917	1,962
Feed fed 1999 (Kg)	1308	435	11467	n/a	106	1094	2057
Wt. Gained 1999(Kg)	1349	215	13831	n/a	429	742	791
Conversion	0.97	2.02	0.83	n/a	0.25	1.47	2.60
# On Hand 12/31/99	-	1,193	13,066	389	99,644	-	-
Wt. On Hand 12/31/99	-	127	5,486	n/a	429	-	-
Production Costs	\$9,466.26	\$1,508.71	\$97,055.45	n/a	\$3,010.40	\$5,206.79	\$5,550.64
C.Y. 98 Prod. Net Cost	\$11,440	\$1,823	\$117,287	n/a	\$3,638	\$6,292	\$6,708
Cost/Kg C.Y. 98	\$8.48	\$8.48	\$8.48	\$8.48	\$8.48	\$8.48	\$8.48
C.Y. 97 Accrued Cost				\$7	\$0	\$1,314	\$8,794
C.Y. 98 Accrued Cost	\$ 4,731	\$ 105	\$ 5,730				
Total Accrued Production	630	229	14594	n/a	429	917	1962
Cost per kilogram	\$7.02	\$7.02	\$7.02	n/a	\$7.02	\$7.02	\$7.02

Species	Rainbow Trout	Rainbow Trout	Rainbow Trout	Rainbow Trout	Rainbow Trout	Rainbow Trout	Rainbow Trout
Lot	RBT-C97BR	RBT-C97F	RBT-M99S	RBT-M98S	RBT-R97F	RBT-S98S	RBT-S99S
Source	Cleghorn	Cleghorn	Ennis NFH	Ennis NFH	Ennis NFH	White Sulphur	White Sulphur
Date Received	8/97-10/97	Oct-97	1/26/1999	1/26/1999	8/6/1997	3/2/1998	1/10/99&2/23
# @ Initial Feeding	800	78,000	300,000	300,000	75,000	90,000	148,305
Wt. @ Initial Feeding	0.1	9.4	36.14	36.14	9.04	10.84	17.87
Date of Initial feeding	Nov-97	Dec-97	3/1/1999	3/1/1999	Oct-97	Apr-98	3/15/1999
# On Hand 1/1/97	773	24,660	-	-	14,579	74,150	-
Wt. 1/1/99	193	1967	0	0	3323	2554	0
# Stocked 1999	-	21,803	55,456	165,896	13,465	64,273	22,502
Wt. Stocked 1999 (Kg)	0	6,800	1,592	1,780	8,165	11,884	335
Feed fed 1998 (Kg)	1377	5090	3990	3990	12746	1669.4	1669.4
Wt. Gained 1999 (Kg)	314	4833	3536	3724	4,842	9330	8035
Conversion	4.39	1.05	1.13	1.07	2.63	0.18	0.21
# On Hand 12/31/99	581	-	21,800	21,800	-	-	69,524
Wt. On Hand 12/31/99	507	-	1,944	1,944	-	-	7,700
Production Costs	\$ 2,203.41	\$ 33,914.32	\$ 24,812.96	\$ 26,132.20	\$ 33,977.48	\$ 65,470.85	\$ 56,383.53
C.Y. 98 Prod. Net Cost	\$2,663	\$40,984	\$29,985	\$31,580	41,060	\$79,118	\$68,137
Cost/Kg C.Y. 98	\$8.48	\$8.48	\$8.48	\$8.48	\$8.48	\$8.48	\$8.48
C.Y. 97 Accrued Cost	\$1,449	\$14,772	\$0	\$0	\$24,956	\$19,181	\$0
C.Y. 98 Accrued Cost							
Total Accrued Production	507	6800	3536	3724	8165	11884	8035
Cost per kilogram	\$7.02	\$7.02	\$7.02	\$7.02	\$7.02	\$7.02	\$7.02

Figure 1. Mean monthly water quality samples taken from the flume (hatchery effluent) showing



nitrogen-ammonia (NH₃-N), total suspended solid (TSS), and biological oxygen demand (BOD). Also shown are the daily maximum allowable limits for TSS and BOD.

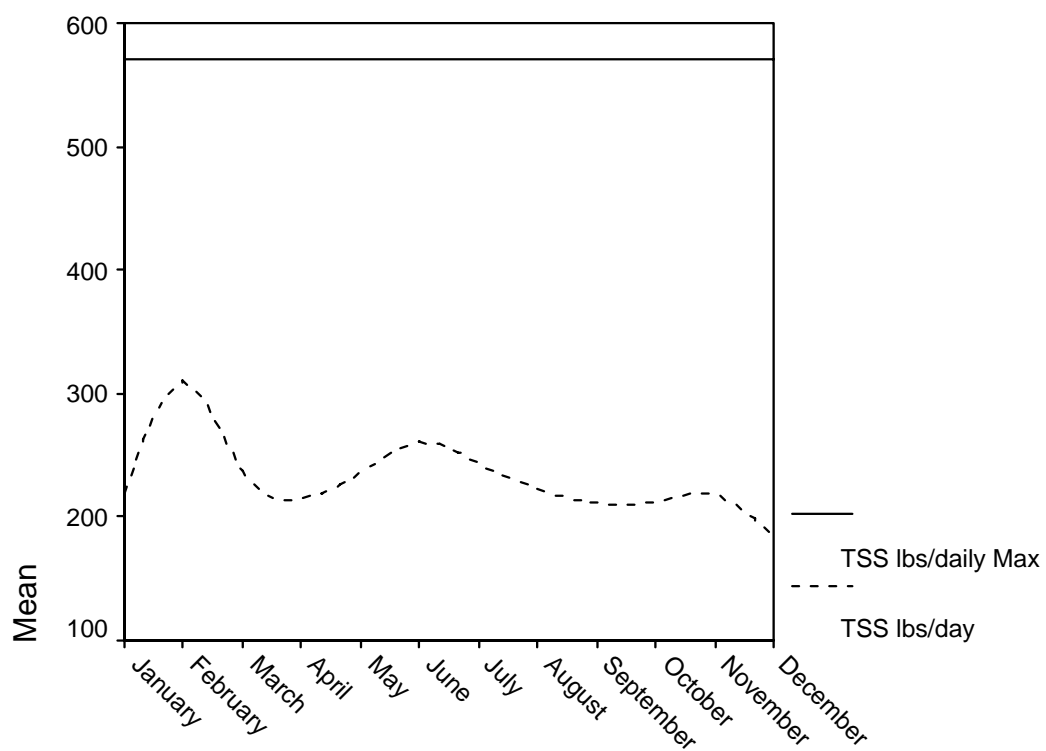


Figure 2. Mean monthly calculated total suspended solids from hatchery effluent and daily maximum limit for calculated total suspended solids.

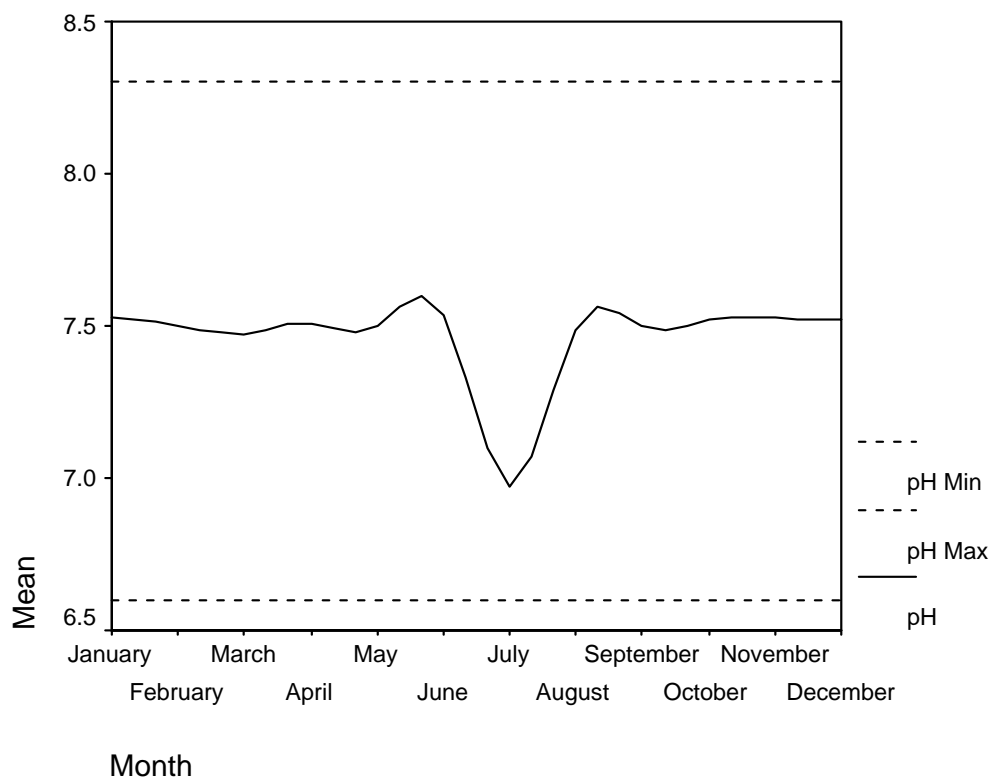


Figure 3. Mean monthly pH levels from hatchery effluent with daily minimum and maximum levels.

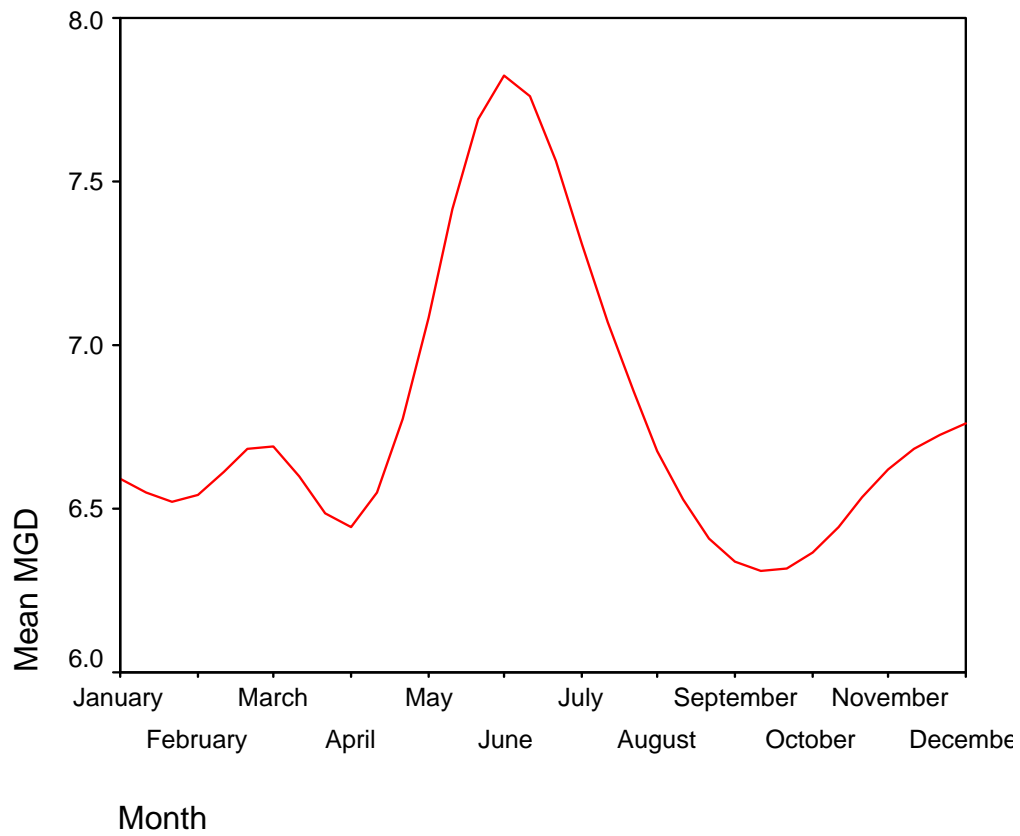


Figure 4. Mean monthly water usage in millions of gallons/day.

CLEGHORN FISH HATCHERY ANNUAL PRODUCTION REPORT 2000

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Spring water collected 4.5 m. underground flows by gravity pipeline to a 67 Kw vertical axis turbine pump, which discharges to two degassing towers. The main tower with four 1 m. o.d. x 2 m. High degassing columns supplies water by gravity to the head of the raceways at the west end of the raceways. The smaller tower, with one column, supplies water to the hatchery building. Degassing and re-oxygenation are accomplished in the sealed aluminum columns filled with 3.8 cm (1.5") Flexi-Ring diffusers. Three Airsep model AS 250 pressure swing absorption generators in parallel provide 100 liters /min of oxygen with 100% back up capacity. Two 30 Kw Sullaire rotary screw air compressors supply air to the oxygen generators through a 0.6 Kw (3/4hp) UltraAir dryer and a 1500 l pressure tank. An emergency back-up system of twenty "K" size oxygen cylinders with a capacity 150 cubic meters (5000 CU.FT.)@ 14 Mpascals (2000 psi) supplies emergency oxygen when system pressure drops below normal

(45psi) operating pressure. This bank is kept filled by a Haskell pneumatic booster pump. Oxygen is also added to the 8 most heavily loaded raceways with portable oxygen contractors.

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SUPPLY WATER QUALITY AND QUANTITY

The flow of water from Cleghorn Springs through the hatchery site averages close to 12cfs. About 10 cfs of this amount is gauged discharging from the Parshall flume on the settling basin. Flow rates fluctuate slightly annually, seasonally, and with competitive demand from the Rapid City Jackson Springs pumping station. No significant fluctuations have occurred in the chemical nature of the water supply since 1973. Water levels were fairly stable this year. An application to update the water rights to the correct historical use level was filed and argued before the water board in December 2000. The outcome of the application is still pending at this time.

FISH CULTURE ACTIVITIES

The large rainbow trout program continues to be very popular. No significant problems were encountered getting them up to size. Floating extruded pellet diets with canthaxanthin, a pigment that enhances skin and flesh color, continues to produce pleasing external and internal color in the rainbow trout. Some fish losses occurred from low oxygen problems associated with the low inflow head on the raceways. A stand pipe blew off in the middle of the night dewatering ponds containing 1200 rainbow trout brood stock and 10,000 trout destined for Pactola Reservoir. This is continuing problem with the deteriorating raceways and drain system has been identified as a critical issue in the capital budget planning process. On the 15th of December the main water pump failed and emergency repairs were undertaken. It took about two weeks to get the pump rebuilt and installed. During that period the engine on the back up pump failed. The outside fish were put on gravity flow and reduced feed levels, while the inside fish were kept alive using portable gasoline fueled pumps and in-line oxygen contactors developed earlier for emergency backup. The facility was staffed 24 hours a day to keep the pumps fueled and monitor the oxygen levels at critical check points. The facility operated under critical conditions for nearly 3 weeks as both main pumps were repaired and oxygen system problems were dealt with. No fish were lost during this period although reduced feeding levels resulted in slightly undersized fish stocked during the first part of the season. Time spent developing and practicing emergency procedures was the key to successfully protecting our investment.

FISH HEALTH

Fish health management continues to be a very low level activity. Strict adherence to acceptable loading and fish husbandry techniques has prevented any detectable acute losses of fish. Annual inspections are conducted for each lot of fish on station and no occurrence of any tested pathogens has been reported. There have been some episodes of fin damage associated with mechanically induced water quality problems, but these areas are included in our future CIP improvements.

EFFLUENT WATER QUALITY

Cleghorn Springs Trout Hatchery is in the process of renewing its NPDES permit SD-0000060. Careful production programming and operating keep water quality within the permit limits set by the Environmental Protection Agency. Water is sampled and analyzed weekly for TSS (total suspended solids), BOD (biological oxygen demand), pH and monthly for ammonia. A quarterly sample taken during pond cleaning is tested for TSS and ammonia. Nitrogen-ammonia levels did not exceed 0.5 mg/l and remained fairly constant ranging from 0.0 to 0.5 mg/l throughout the year. Total suspended solids ranged from 4 to 5mg/l. Biological oxygen demand (BOD) ranged between 1.0 and 4.75 mg/l (Figure 2). Total suspended solids ranged from 54 to 462 lbs/day with an average of 230 lbs. /day being produced (Figure 3). The mean monthly pH level was 7.5 with a range of 7.2 to 7.6 (Figure 4). Mean monthly water usage in millions of gallons per day was 6.75 with a range of 6.06 to 8.29 (Figure 5).

APPENDIX A.

LOT HISTORIES

Lot histories provide an archive of production data that is useful for long range production and cost analysis. This information shows the cost relationships among sizes of fish as well as other production costs that may vary by year or program. Since fish cost is a function of its rearing time in the hatchery, there is an averaging effect for a given lot of fish when stocked over an extended period of time. This would be most evident for catchables and brood stock. The information included for each lot starts with the species. The species code follows the Federal fish species acronym list. The first group of letters identifies the specie(s), after the dash if applicable, is a single letter that identifies the strain, followed by the year obtained and finally a letter that designates either fall (F) or spring (S) spawned. A list of strains follows.

A.....	Arlee
E.....	Eagle Lake
G.....	Growth
K.....	Kamloops
L.....	Fish Lake
M.....	McConaughy
O.....	Oahe
S.....	Shasta

Species	Brown trout	Rainbow Trout	Rainbow Trout	Rainbow Trout	Rainbow Trout
Lot	BNT-P98F	RBTC98F	RBT-C99F	RBT-K97BR	RBT-C00BR
Source	Saratoga	Cleghorn	Cleghorn	Cleghorn	Cleghorn
Date Received	11/3/98	9/98	8/99-11/99	8/97-10/97	8/00-10/00
# @ Initial Feeding	20,000	375,000	110,000	800	7,700
Wt. @ Initial Feeding	2.41	45.18	13.25	0.10	0.10
Date of Initial feeding	12/98	11/98	11/99	11/97	11/01/00
# On Hand 1/1/00	1,193	13,066	99,644	581	-
Wt. 1/1/00	127	5486	429	507	0
# Stocked 2000	1,184	14,935	107,693	210	-
Wt. Stocked 2000 (Kg)	276	10,101	9,448	805	0
Feed fed 2000 (Kg)	250	5577.1914	rbtc99f	0	0
Wt. Gained 2000 (Kg)	149	4615	12935	916	30
Conversion	1.68	1.21			0.00
# On Hand 12/31/00	-	-	7,415	375	7,600
Wt. On Hand 12/31/00	-	-	3,916	618	30
C.Y. 00 Production Net Cost	\$1,395	\$43,198	\$121,075	\$8,574	\$281
Labor	\$711.29	\$22,030.78	\$61,748.24	\$4,372.74	\$143.21
Facility and Operations	\$683	\$21,167	\$59,327	\$4,201	\$138
Cost/Kg C.Y. 00	\$9.36	\$9.36	\$9.36	\$9.36	\$9.36
C.Y. 99 Accrued Cost	\$16,172	\$954	\$3,638	\$4,112	\$0
C.Y. 99 Accrued Prod.	\$630	\$229	\$429	\$507	0
Total Accrued Production	779	4844	13364	1423	30
Cost per kilogram	\$22.55	\$9.11	\$9.33	\$8.91	\$9.36

Species	Rainbow Trout	Rainbow Trout	Rainbow Trout	Rainbow Trout
Lot	RBT-C00BR	RBT-C00F	RBT-M99S	RBT-M00S
Source	Cleghorn	Cleghorn	Ennis NFH	Ennis NFH
Date Received	8/00-10/00	8/00-10/00	01/26/1999	01/25/2000
# @ Initial Feeding	7,700	363,000	300,000	300,000
Wt. @ Initial Feeding	0.10	0.10	36.1	36.1
Date of Initial feeding	11/01/00	Nov-00	03/01/1999	03/01/2000
# On Hand 1/1/00	-	-	21,800	
Wt. 1/1/00	0	0	1944	
	-	-	21,159	128,727
Wt. Stocked 2000 (Kg)	0	0	2,880	474
Feed fed 2000 (Kg)	14.8	367.4968	rbtm99s	0
Wt. Gained 2000 (Kg)	30	563	936	3122
Conversion	0.49	0.65		
# On Hand 12/31/00	7,600	149,213	-	37,400
Wt. On Hand 12/31/00	30	563	-	2,648
C.Y. 00 Production Net Cost	\$281	\$5,270	\$8,761	\$29,223
Labor	\$143.21	\$2,687.61	\$4,468.21	\$14,903.60
Facility and Operations	\$138	\$2,582	\$4,293	\$14,319
Cost/Kg C.Y. 00	\$9.36	\$9.36	\$9.36	\$9.36
C.Y. 99 Accrued Cost	\$0	\$0	\$29,985	\$0
C.Y. 99 AccruedProd.	0	0	3536	0
Total Accrued Production	30	563	4472	3122
Cost per kilogram	\$9.36	\$9.36	\$8.66	\$9.36

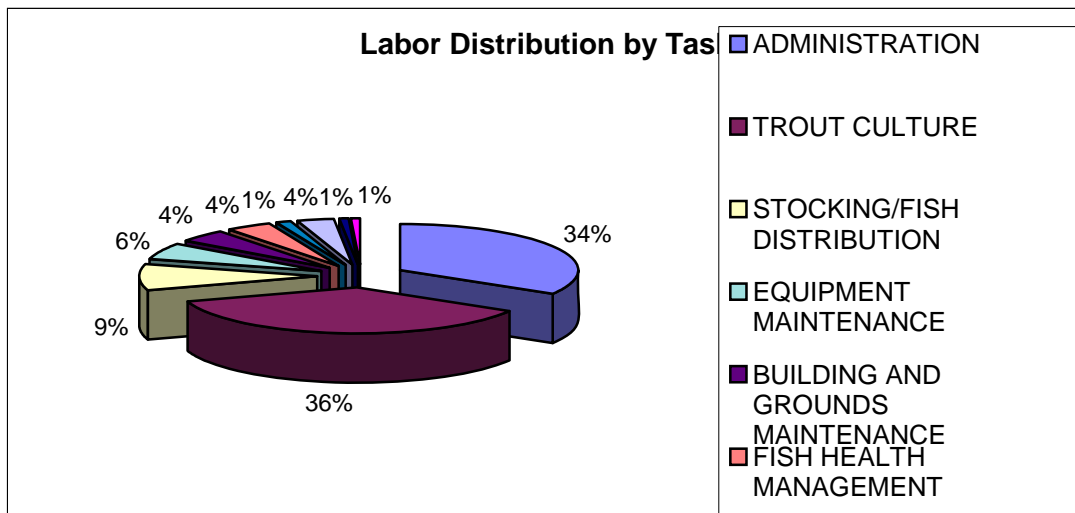


Figure 1. Labor Distribution by task for 2000.

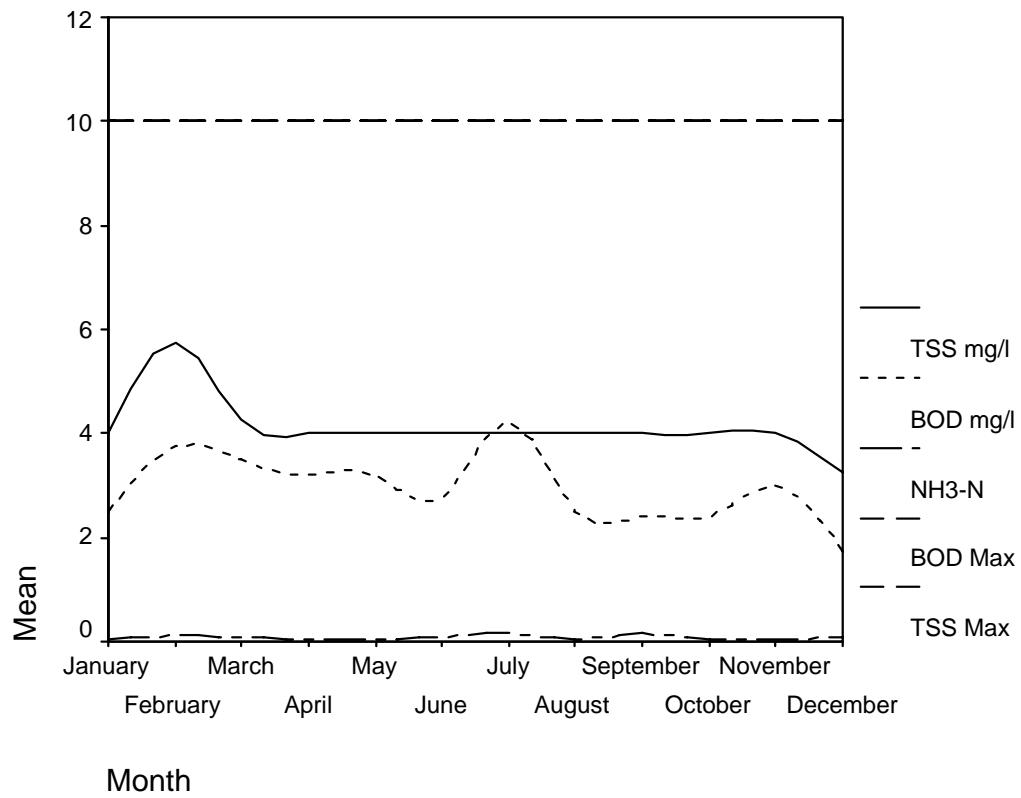


Figure 2. Mean monthly water quality samples taken from the flume (hatchery effluent) showing nitrogen-ammonia (NH₃-N), total suspended solid (TSS), and biological oxygen demand (BOD). Also shown are the daily maximum allowable limits for TSS and BOD.

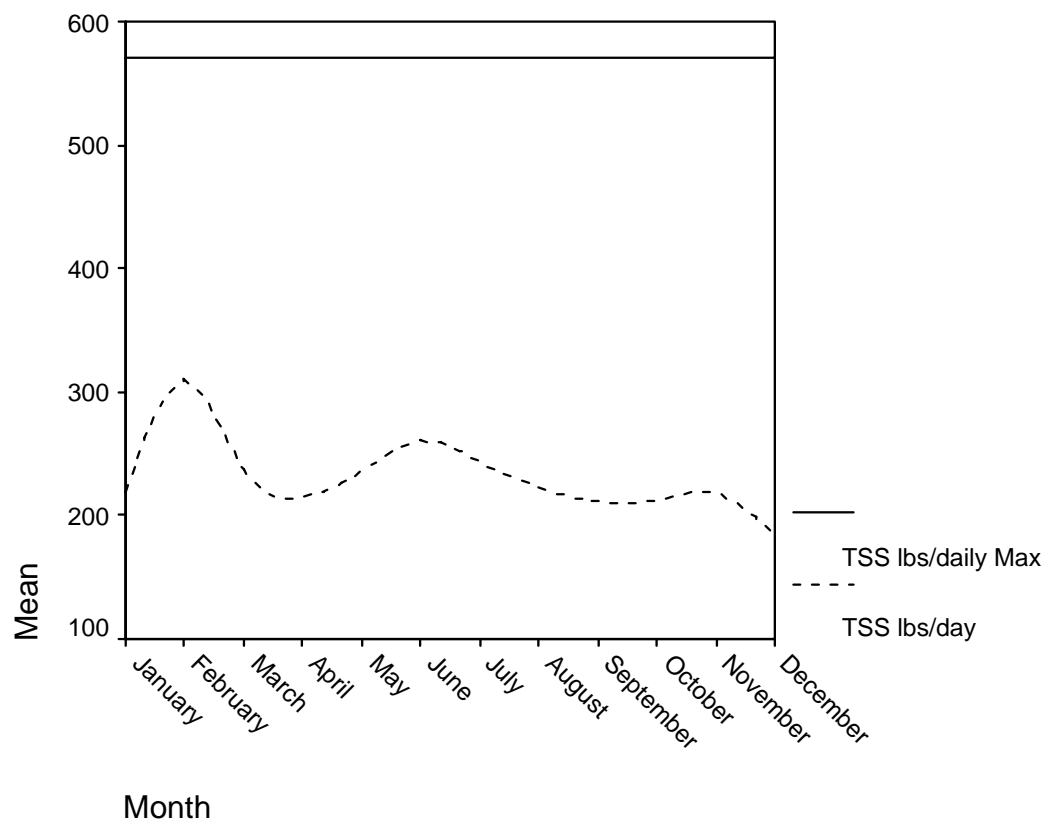


Figure 3. Mean monthly calculated total suspended solids from hatchery effluent and daily maximum limit for calculated total suspended solids.

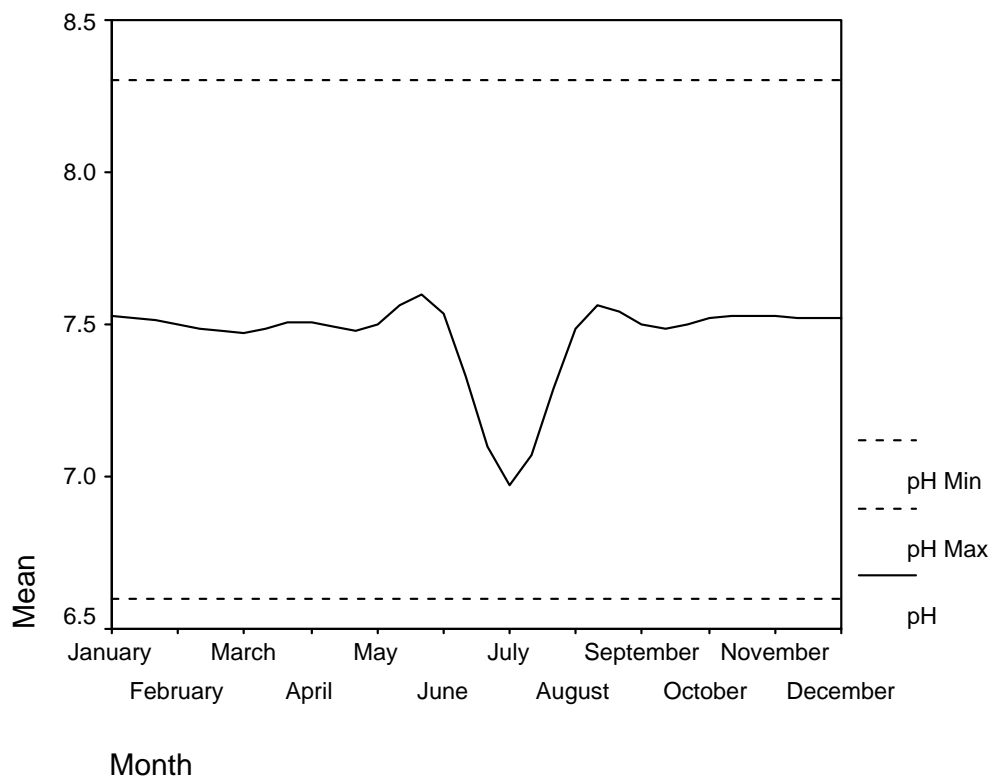


Figure 4. Mean monthly pH levels from hatchery effluent with daily minimum and maximum levels.

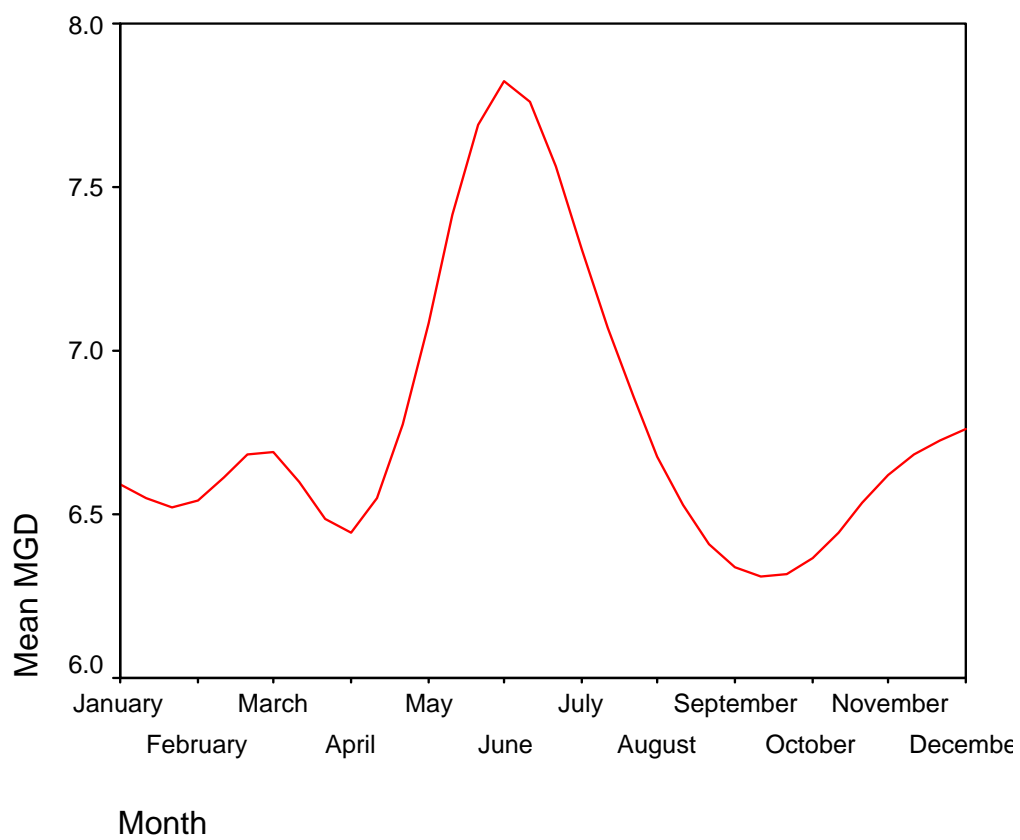


Figure 5. Mean monthly water usage in millions of gallons/day.

Table 1. Calendar Year 2000 Stocking summary by program, species:
rainbow trout (RBT), brown trout (BNT), size and cost.

Program	species	Size	Number	Weight	Cost
Large Lakes and Reservoirs					
	RBT				
		ADT	228	600	\$5616
		CAT	10,002	1,799	\$16,839
		Program Subtotal	10,230	2,399	\$22,455
Missouri River					
	BNT				
		FNG	6,834	34	\$318
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		CAT	21,159	2,880	\$26,957
		FNG	19,025	309	\$2,892
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		CAT	26	3	\$NA transported only
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		ADT	13	6	\$NA transported only
		CAT	391	76	\$NA transported only
	FCS				
		CAT	18	3	\$0
		FNG	1	0.05	\$0
	RBT				
		ADT	2,752	4,503	\$42,148
		CAT	98,743	22,733	\$207,823
		FNG	211,814	1,115	\$10,440
		Program Subtotal	313,859	28,444	\$266,244
Streams					
	BNT				
		CAT	10,650	2,241	\$20,979
	RBT				
		ADT	2,268	3,035	\$28,410
		CAT	16,355	2,546	\$23,830
		Program Subtotal	29,273	823	\$73,223
Grand Total			400,381	41,889	\$392,09

Table 2. Calendar Year 2000 Operating Expense Summary

Salaries and Benefits	\$200,547
Travel	\$2,401
Contractual Services	\$96,821
Supplies and Materials	\$80,710
Capital Assets	\$7,857
Computer Services	\$3,756
 Total	 \$392,092

Table 3. 2000 Monthly Discharge Data

Date	BOD	TSS mg/L	NH3-N	pH	TSS Lbs/day	CFS	MGD
January 2000							
Avg	3.25	4	0.0	7.55	221.4	10.	6.6479
February 2000							
Avg	2.25	4	0.2	7.52	218.7	10.	6.5665
March 2000							
Avg	2.6	4	0.0	7.43	212.0	9.8	6.3670
April 2000							
Avg	1.75	4	0.3	7.50	213.8	9.9	6.4182
May 2000							
Avg	2	4	0.0	7.51	216.0	10.	6.4854
June 2000							
Avg	2.6	4	0.1	7.05	206.0	9.5	6.1862
July 2000							
Avg	3	4	0.1	7.49	201.8	9.3	6.0591
August 2000							
Avg	3.25	4	0.0	7.46	185.4	8.6	5.5662
September 2000							
Avg	2.6	4.2	0.1	7.52	172.9	7.6	4.9592
October 2000							
Avg	2	5	0.5	7.45	256.6	9.5	6.1643
November 2000							
Avg	4.75	5	0.5	7.50	254.3	9.4	6.1085
December 2000							
Avg	1	5	0.5	7.56	268.9	9.9	6.4594

Table 4. Summary of 2000 spawning showing number of eggs produced at Cleghorn, transferred to McNenny State Fish Hatchery and received from other sources by date and strain.

Year 2000	Total Eggs:	969168			
	Strain	RBT-C00F	Total	688189.	
	Source	Strain		Total Eggs for	Transferred to
08/30/2000	Cleghorn	RBT-C00F		82839	41430
09/05/2000	Cleghorn	RBT-C00F		128340	
09/12/2000	Cleghorn	RBT-C00F		172000	172000
09/19/2000	Cleghorn	RBT-C00F		97875	97875
09/26/2000	Cleghorn	RBT-C00F		144035	
10/03/2000	Cleghorn	RBT-C00F		63101	
	Strain	RBT-C97F	Total	123773.	
	Source	Strain		Total Eggs for	Transferred to
08/16/2000	Cleghorn	RBT-C97F		39893	
08/23/2000	Cleghorn	RBT-C97F		83881	
	Strain	RBT-S00S	Total	157205.	
	Source	Strain		Total Eggs for	Transferred to
02/16/2000	White Sulphur Springs	RBT-S00S		157205	

CLEGHORN FISH HATCHERY ANNUAL PRODUCTION REPORT 2001

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Table 2. Calendar Year 2001 Operating Expense Summary

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Travel	\$1,543
Contractual Services	\$168,949
Supplies and Materials	\$78,415
Capital Assets	\$9,214

Mature brood fish are fed a maintenance diet to cut growth while maintaining condition. Younger brood fish are fed at production rates until age 2. Spawning operations were conducted from late August through October. Fish were sorted for ripeness weekly and ripe fish were spawned the day after sorting. Females three years and older were air spawned; while 2 year olds, which are easy to handle, were hand spawned. Table 3 summarizes the 2001 operations. Total egg production for the year was just under a million eggs. Just over 300,000 eggs were used to meet Cleghorn Springs needs, 311,000 were shipped to McNenny and the balance were discarded (\$6,000 worth).

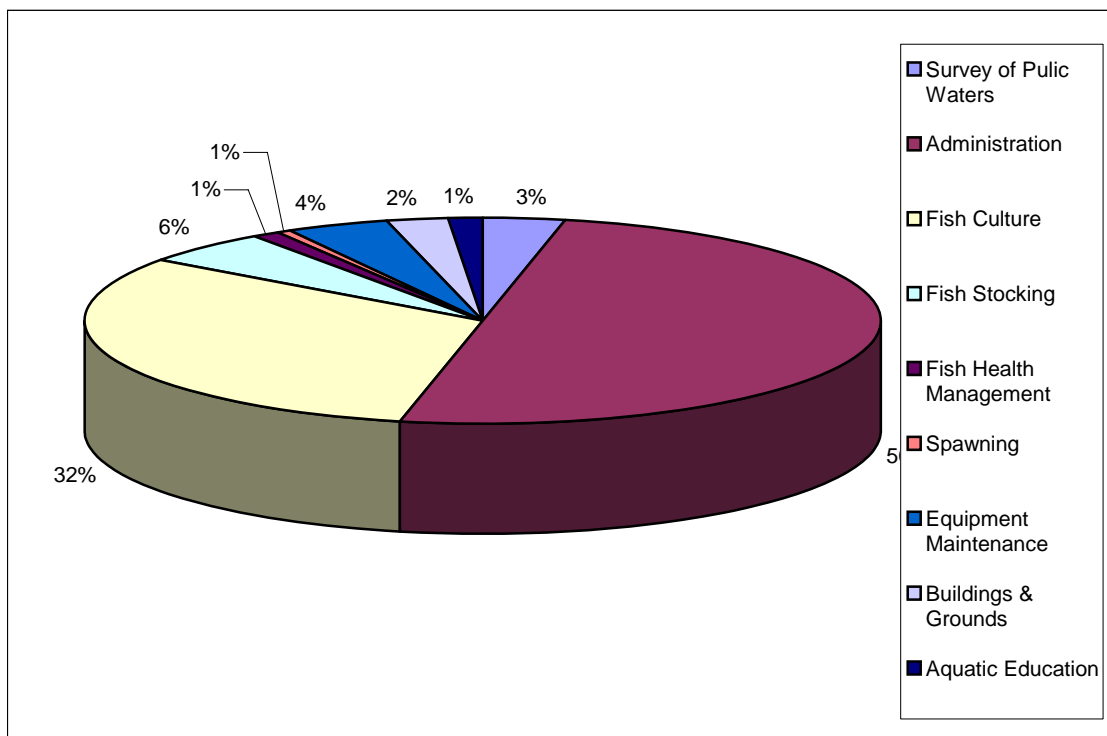


Figure 1. Labor Distribution by Task.

Table 3. Summary of 2001 spawning showing number of eggs produced at Cleghorn, number transferred to McNenny State Fish Hatchery and number received from other sources by date and strain.

Year2001		Total Eggs:	1434758	Total Transferred	311305
Strain	RBT-C00F	Total Eggs	780729		
	Source	Strain	Total Eggs for Day	Transferred to McNenny	
08/30/2001	Cleghorn	RBT-C00F	82839	41430	
09/05/2001	Cleghorn	RBT-C00F	128340		
09/12/2001	Cleghorn	RBT-C00F	172001	172001	
09/19/2001	Cleghorn	RBT-C00F	97875	97875	
09/26/2001	Cleghorn	RBT-C00F	144035		
10/03/2001	Cleghorn	RBT-C00F	63101		
10/10/2001	Cleghorn	RBT-C00F	92540		
Strain	RBT-C97F	Total	163698		
	Source	Strain	Total Eggs for Day	Transferred to McNenny	
08/16/2001	Cleghorn	RBT-C97F	79818		
08/23/2001	Cleghorn	RBT-C97F	83881		
Strain	RBT-M00S	Total	333125		
	Source	Strain	Total Eggs for Day	Transferred to McNenny	
01/25/2001	Ennis	RBT-M00S	333125		
Strain	RBT-S00S	Total	157205.		
	Source	Strain	Total Eggs for Day	Transferred to McNenny	
2/16/2001	White Sulphur Springs	RBT-S00S	157205		

SUPPLY WATER QUALITY AND QUANTITY

The flow of water from Cleghorn Springs through the hatchery site averages close to 12cfs. About 10 cfs of this amount is gauged discharging from the Parshall flume on the settling basin. Flow rates fluctuate slightly annually, seasonally, and with competitive demand from the Rapid City Jackson Springs pumping station. No significant fluctuations have occurred in the chemical nature of the water supply since 1973. Water levels were fairly stable this year. An application to update the water rights to the correct historical use level was filed and argued before the water board in December 2001. The outcome of the application is still pending at this time.

FISH CULTURE ACTIVITIES

The large rainbow trout program continues to be very popular. No significant problems were encountered getting them up to size. Floating extruded pellet diets with canthaxanthin, a pigment that enhances skin and flesh color, continues to produce pleasing external and internal color in the rainbow trout. Some fish losses occurred from low oxygen problems associated with the low inflow head on the raceways. A stand pipe blew off in the middle of the night dewatering ponds containing 1200 rainbow trout brood stock and 10,000 trout destined for Pactola Reservoir. This is continuing problem with the deteriorating raceways and drain system has been identified as a critical issue in the capital budget planning process. On the 15th of December the main water pump failed and emergency repairs were undertaken. It took about

two weeks to get the pump rebuilt and installed. During that period the engine on the back up pump failed. The outside fish were put on gravity flow and reduced feed levels, while the inside fish were kept alive using portable gasoline fueled pumps and in-line oxygen contactors developed earlier for emergency backup. The facility was staffed 24 hours a day to keep the pumps fueled and monitor the oxygen levels at critical check points. The facility operated under critical conditions for nearly 3 weeks as both main pumps were repaired and oxygen system problems were dealt with. No fish were lost during this period although reduced feeding levels resulted in slightly undersized fish stocked during the first part of the season. Time spent developing and practicing emergency procedures was the key to successfully protecting our investment.

RESEARCH AND DEVELOPMENT

Liquid Oxygen System

Operating and maintenance costs of the oxygen generating system have been under evaluation as part of long range capital equipment replacement planning. An Equivalent Uniform Annual worth (EUAW) analysis was commissioned thru the South Dakota School of Mines and Technology to evaluate options for maintaining a reliable oxygen supply. The EUAW approach looks at all of the costs associated with operating and maintaining a system and compares that to several replacement options. When the cost to replace is equal to or less than the cost to maintain the equipment should be replaced. The current system was compared with four alternate systems based on liquid oxygen. The study recommended replacing the current system with a purchased 3000 gallon liquid oxygen storage and delivery system. The expected benefits would include: Very high reliability, immunity to power outages, and a reduction in operating expenses. The hatchery staff developed specifications for the system and selected a site location. A request for proposals was advertised by the State Engineers office resulting in a contract being awarded November 30 with construction to be completed by early spring 2002. Following more than three years of engineering studies conducted by the hatchery manager in cooperation with senior engineering design teams from the South Dakota School of Mines and Technology, a comprehensive evaluation was done on the facilities, infrastructure, and production processes at Cleghorn Springs. The results of these studies combined with the continuing mechanical failures reported above provided impetus to develop an RFP for an independent evaluation by an aquaculture consultant. A contract was awarded to Montgomery Watson in February with the completion report in August 2001. Recommendations from this report and from staff evaluations were summarized in a power point presentation to the Game, Fish & Parks Commissioners in December. The recommendations resulting from the work and presentation were to start the process to design and construct the needed improvements. That process will be initiated next year.

FISH HEALTH.

Fish health management continues to be a very low level activity. Strict adherence to acceptable loading and fish husbandry techniques has prevented any detectable acute losses of fish. Annual inspections are conducted for each lot of fish on station and no occurrence of any tested pathogens has been reported. There have been some episodes of fin damage associated with mechanically induced water quality problems. Anticipated capital improvements will eliminate these problems.

EFFLUENT WATER QUALITY

Cleghorn Springs Trout Hatchery is in the process of renewing its NPDES permit SD-0000060. Careful production programming and operating keep water quality within the permit limits set by the Environmental Protection Agency. Water is sampled and analyzed weekly for TSS (total suspended solids), BOD (biological oxygen demand), pH and monthly for ammonia. A quarterly sample taken during pond cleaning is tested for TSS and ammonia. Nitrogen-ammonia levels did not exceed 0.5 mg/l and remained fairly constant ranging from 0.0 to 0.5 mg/l throughout the year (figure 2). Total suspended solids ranged from 4 to 5mg/l (Figure 2). Biological oxygen demand (BOD) ranged between 1.0 and 4.75 mg/l (Figure 2). Total suspended solids ranged from 172 to 268 lbs/day with an average of 230 lbs. /day being produced (Figure 3). The mean monthly pH level was 7.5 with a range of 7.2 to 7.56 (Figure 4). Mean monthly water usage in millions of gallons per day was 6.75 with a range of 4.95 to 8.29 (Figure 5).

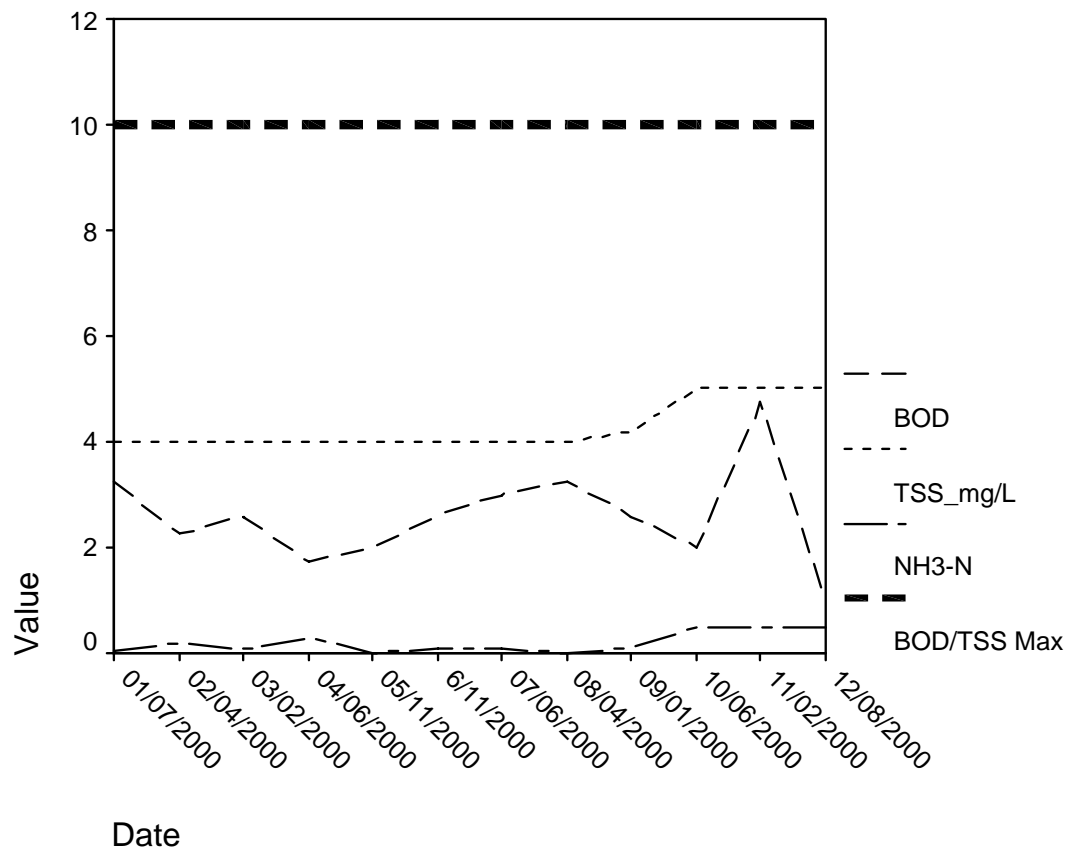


Figure 2. Mean monthly water quality samples taken from the flume (hatchery effluent) showing nitrogen-ammonia (NH₃-N), total suspended solid (TSS), and biological oxygen demand (BOD). Also shown are the daily maximum allowable limits for TSS and BOD.

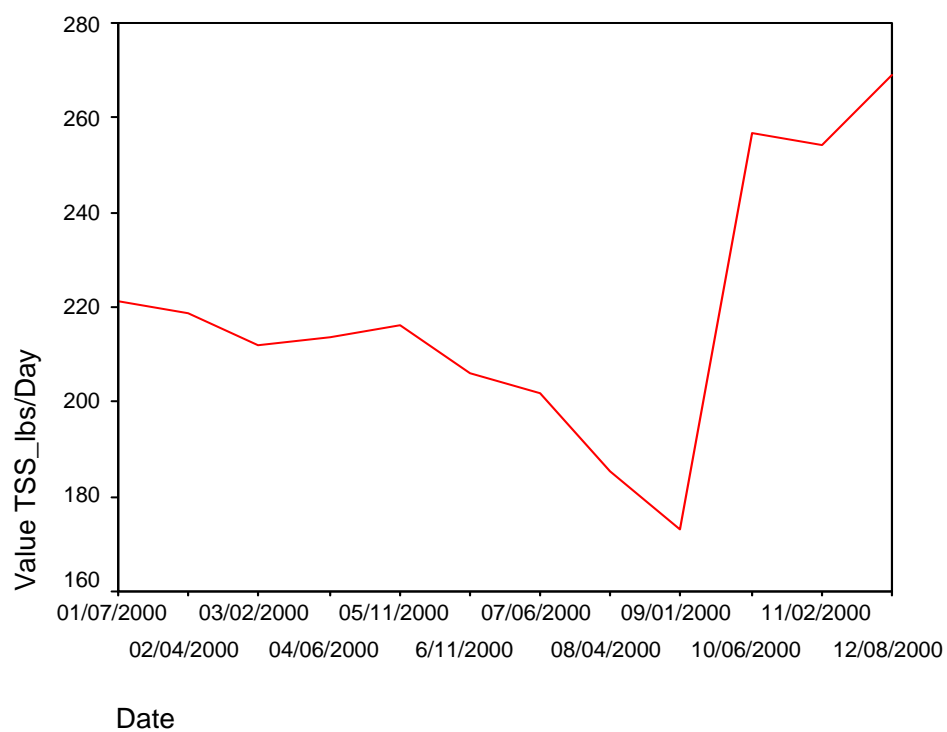


Figure 3. Mean monthly calculated total suspended solids from hatchery effluent. .

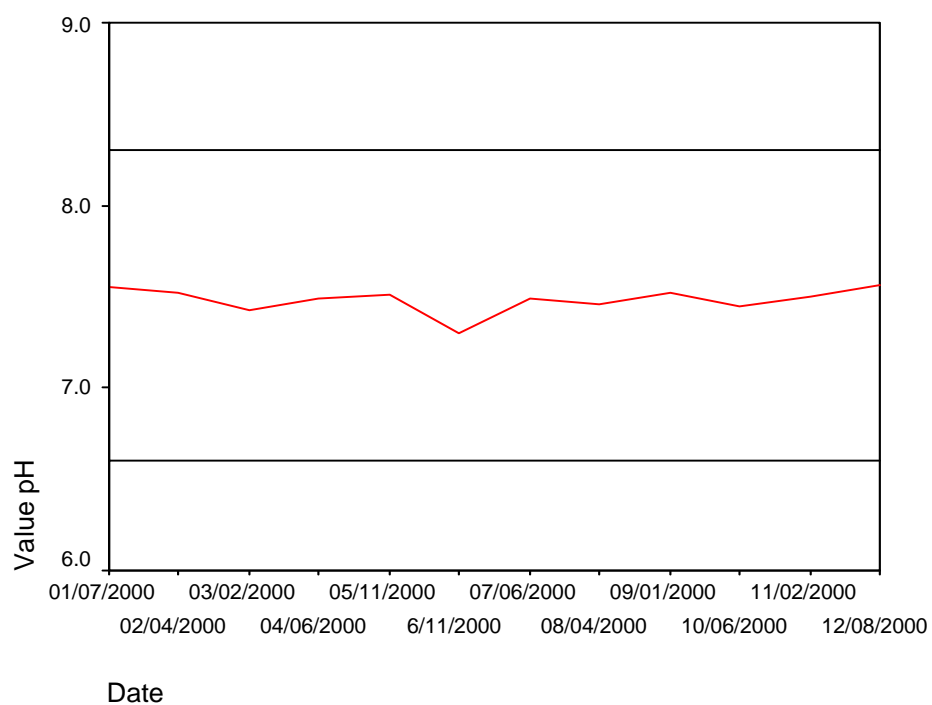


Figure 4. Mean monthly pH levels from hatchery effluent with daily minimum and maximum levels.

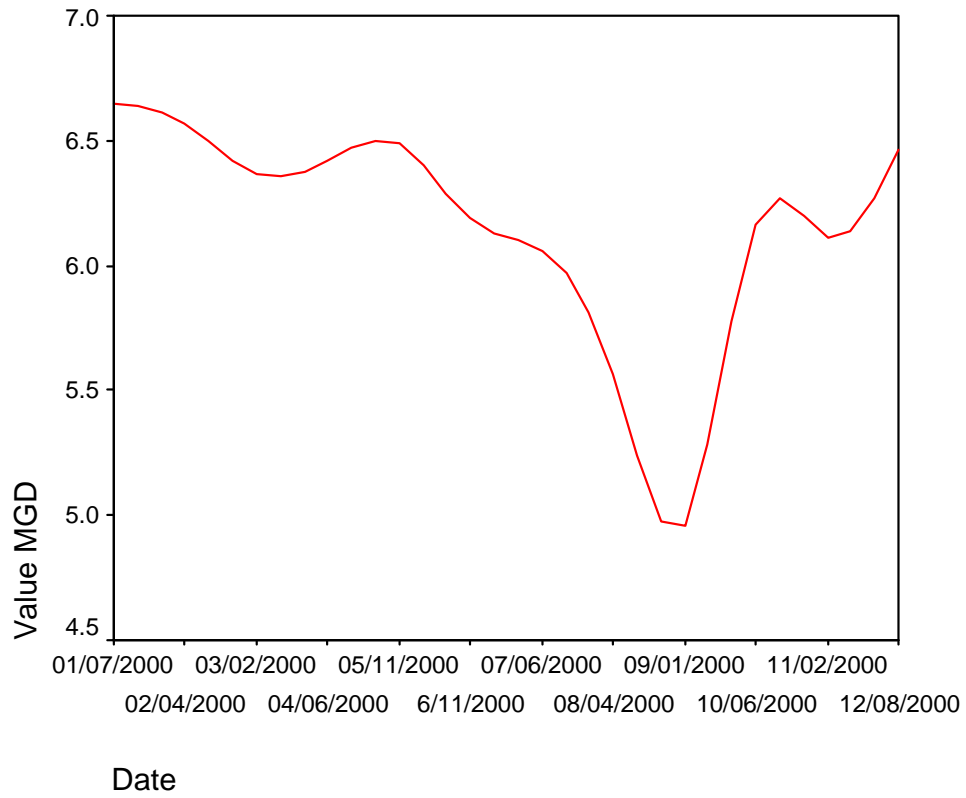


Figure 5. Mean monthly water usage in millions of gallons/day.

APPENDIX A.

LOT HISTORIES

Lot histories provide an archive of production data that is useful for long range production and cost analysis. This information shows the cost relationships among sizes of fish as well as other production costs that may vary by year or program. Since fish cost is a function of its rearing time in the hatchery, there is an averaging effect for a given lot of fish when stocked over an extended period of time. This would be most evident for catchables and brood stock. The information included for each lot starts with the species. The species code follows the Federal fish species acronym list. The first group of letters identifies the specie(s), after the dash if applicable, is a single letter that identifies the strain, followed by the year obtained and finally a letter that designates either fall (F) or spring (S) spawned. A list of strains follows.

A.....	Arlee
E.....	Eagle Lake
G.....	Growth
K.....	Kamloops
L.....	Fish Lake
M.....	McConaughy
O.....	Oahe
S.....	Shasta

Species	Brown trout	Rainbow Trout	Rainbow Trout	Rainbow Trout	Rainbow Trout
Lot	BNT-P98F	rbtc98f	RBT-C99F	RBT-K97BR	RBT-C00BR
Source	Saratoga	Cleghorn	Cleghorn	Cleghorn	Cleghorn
Date Received	11/3/98	9/98	8/99-11/99	8/97-10/97	8/00-10/00
# @ Initial Feeding	20,000	375,000	110,000	800	7,700
Wt. @ Initial Feeding	2.409638554	45.18	13.25	0.10	0.10
Date of Initial feeding	12/98	11/98	11/99	11/97	11/01/00
# On Hand 1/1/00	1,193	13,066	99,644	581	-
Wt. 1/1/00	127	5486	429	507	0
# Stocked 2001	1,184	14,935	107,693	210	-
Wt. Stocked 2001 (Kg)	276	10,101	9,448	805	0
Feed fed 2001 (Kg)	250	5577.1914	rbtc99f	0	0
Wt. Gained 2001 (Kg)	149	4615	12935	916	30
Conversion	1.68	1.21			0.00
# On Hand 12/31/00	-	-	7,415	375	7,600
Wt. On Hand 12/31/00	-	-	3,916	618	30
C.Y. 00 Production Net Cost	\$1,395	\$43,198	\$121,075	\$8,574	\$281
Labor	\$711.29	\$22,030.78	\$61,748.24	\$4,372.74	\$143.21
Facility and Operations	\$683	\$21,167	\$59,327	\$4,201	\$138
Cost/Kg C.Y. 00	\$9.36	\$9.36	\$9.36	\$9.36	\$9.36
C.Y. 99 Accrued Cost	\$16,172	\$954	\$3,638	\$4,112	\$0
C.Y. 99 Accrued Prod.	\$ 630	\$ 229	\$ 429	\$ 507	0
Total Accrued Production	779	4844	13364	1423	30
Cost per kilogram	\$22.55	\$9.11	\$9.33	\$8.91	\$9.36

Species	Rainbow Trout	Rainbow Trout	Rainbow Trout	Rainbow Trout	Rainbow Trout
Lot	RBT-C00F	RBT-M99S	RBT-M00S	RBT-S99S	RBT-S00S
Source	Cleghorn	Ennis NFH	Ennis NFH	White Sulphur	White Sulphur
Date Received	8/00-10/00	01/26/1999	01/25/2001	1/10/99&2/23	02/16/00
# @ Initial Feeding	363,000	300,000	300,000	148,305	150,000
Wt. @ Initial Feeding	0.10	36.1	36.1	17.87	18.07
Date of Initial feeding	Nov-00	03/01/1999	03/01/2001	03/15/99	04/16/00
# On Hand 1/1/00	-	21,800		69,524	-
Wt. 1/1/00	0	1944		7700	0
# Stocked 2001	-	21,159	128,727	69,455	39,819
Wt. Stocked 2001 (Kg)	0	2,880	474	15,216	440
Feed fed 2001 (Kg)	398.2	1334.454	2949.1	9974	4651.1542
Wt. Gained 2001 (Kg)	563	936	3122	7516	7185
Conversion	0.71			1.33	0.65
# On Hand 12/31/00	149,213	-	37,400	-	92,724
Wt. On Hand 12/31/00	563	-	2,648	-	6,745
C.Y. 00 Production Net Cost	\$5,270	\$8,761	\$29,223	\$70,352	\$67,253
Labor	\$2,687.61	\$4,468.21	\$14,903.60	\$35,879.38	\$34,299.27
Facility and Operations	\$2,582	\$4,293	\$14,319	\$34,472	\$32,954
Cost/Kg C.Y. 00	\$9.36	\$9.36	\$9.36	\$9.36	\$9.36
C.Y. 99 Accrued Cost	\$0	\$29,985	\$0	\$68,137	\$0
C.Y. 99 Accrued Prod.	0	3536	0	8035	0
Total Accrued Production	563	4472	3122	15551	7185
Cost per kilogram	\$9.36	\$8.66	\$9.36	\$8.91	\$9.36

CLEGHORN FISH HATCHERY ANNUAL PRODUCTION REPORT 2002

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LOCATION AND HISTORY

Cleghorn Springs Hatchery, located at the western edge of Rapid City on a 5.4A. Site bordered on the north side by Route 44 and on the south side by Rapid Creek has been in operation since 1928. The site was selected for and named after the large spring that drew homesteaders here in 1889. Hatchery operations housed at another site downstream were moved in after completion of the first facilities in 1928. A single story stone and brick building on the east end of the site served as the incubation, fry rearing and administrative facilities. Twelve earthen ponds fed by gravity surface spring water were used to rear fish to 6" stocking size. Renovations in circa 1934 created 29 smaller stone walled ponds with 7 earth ponds remaining.

The hatchery remained relatively unchanged until the devastating flood of 1972, which destroyed the original building and all of the ponds. Fish stocking operations were maintained by obtaining fish from the United States Fish and Wildlife Service, McNenny Hatchery, neighboring states, and purchases during 1973. A new hatchery building and raceway complex was designed and constructed. Concrete raceways replaced the ponds while the surface spring intakes were replaced with an underground infiltration gallery and a new flood proof pre-cast concrete building completed the re-construction. In 1982, a recirculated water system was installed to increase utilization of the raceways, which were originally oversized in anticipation of developing additional water. Although providing increased flow to the raceways; high dissolved nitrogen levels, low oxygen levels and suspended solids in the re-use water hampered production. The recirculation system was abandoned and a nitrogen degassing/oxygen supplementation system was added in the fall of 1988 resulting in improved production capabilities. Five 10' diameter circular tanks were installed indoors in 1995 to reduce labor demands and improve trout quality.

PRODUCTION UNITS

- 160 Heath incubator trays in 8 stacked units
- 7 Egar upwelling incubator
- 21 Heath Techna fiberglass start tanks 14.5' x 1.75' x 0.75'
- 5 Gemini 10' diameter x 4' deep circular fiberglass tanks
- 10 Concrete raceways 500' x 8' x 2' dividable into 5 ponds each
- 2 Concrete raceways 200' x 16' x 2' dividable into 4 ponds each

WATER PRODUCTION AND TREATMENT SYSTEMS

Spring water collected 4.5 m. underground flows by gravity pipeline to a 67 Kw vertical axis turbine pump, which discharges it to two degassing towers. The main tower with four 1 m. o.d. x 2 m. High degassing columns supplies water by gravity to the head of the raceways at the west end of the raceways. The smaller tower, with one column, supplies water to the hatchery building. Degassing and re-oxygenation are accomplished in the sealed aluminum columns filled with 3.8 cm (1.5") Flexi-Ring diffusers. Three Airsep model AS 250 pressure swing absorption generators in parallel provide 100 liters /min of oxygen with 100% back up capacity. Two 30 Kw Sullaire rotary screw air compressors supply air to the oxygen generators through a 0.6 Kw (3/4hp) UltraAir dryer and a 1500 liter pressure tank. An emergency back-up system of twenty "K" size oxygen cylinders with a capacity 150 cubic meters (5000 CU.FT.)@ 14 Mpascals (2002 psi) supplies emergency oxygen when system pressure drops below normal (45psi) operating pressure. This bank is kept filled by a Haskell pneumatic booster pump. Oxygen is also added to the 8 most heavily loaded raceways with portable oxygen contactors.

The hatchery discharge is permitted and monitored under National Pollution Discharge Elimination System (NPDES) permit # SD 0000060. Wastewater is treated by gravity sedimentation in two parallel flow, 1m.x3m.x30m. (30'x100'x3'), settling basins prior to discharge to Rapid Creek. Settling basin sludge is recycled at the Rapid City composting site.

HATCHERY STAFFING

- Hatchery Manager
- Assistant Hatchery Manager
- Biologist
- Two Conservation Technicians

PRODUCTION SUMMARY

Total number, weight, and operational cost for fish stocked during calendar year 2002 at Cleghorn Springs are summarized in Table 1. Costs are based on direct labor, feed, production overhead, stocking, and site administrative overhead costs. Production overhead includes water pumping, degassing, oxygenation, and facility and grounds maintenance costs. These costs are prorated by unit weight to arrive at total production cost of a given fish lot. They do not include capital costs associated with the hatchery nor do they include administrative overhead above the site level. Unit cost may vary slightly among lots, but in general terms the cost to rear a fish of a given weight/age is constant.

Total accrued cost for each lot of fish is listed in the lot history (appendix 1). Monthly expenditure records are summarized by calendar year to obtain the annual costs associated with each lot, which is added to the accrued cost in the lot history. Total annual expenditures (Table 2.) reflect the cost of the total weight of fish produced during the year regardless of whether or not they were stocked or held over. Calendar year expenditures are similar to, but not equal to, fiscal budget year expenditures. This results from posting dates and fund balance transfers occurring at the end of fiscal year accounting cycles. The average cost per kilogram of production multiplied by the kilograms of production for a twelve-month period gives a figure close to an average fiscal year operational budget. Figure 1. Illustrates how the calendar year labor was distributed. This calendar year workers were available from the Community Alternatives work release program in Rapid City. Nearly 3,000 man hours were used that are not tracked in our accounting system. The grounds and building maintenance was almost entirely performed with these services and they are not reflected in Figure 1.

Mature brood fish are fed a maintenance diet to cut growth while maintaining condition. Younger brood fish are fed at production rates until age 2. Spawning operations were conducted from late August through October. Fish were sorted for ripeness weekly and ripe fish were spawned the day after sorting. Females three years and older were air spawned; while 2 year olds, which are easy to handle, were hand spawned. Table 3 summarizes the 2002 operations. Total egg production for the year was just under a million eggs. Just over 300,000 eggs were used to meet Cleghorn Springs needs, 311,000 were shipped to McNenny and the balance were discarded (\$6,000 worth).

SUPPLY WATER QUALITY AND QUANTITY

The flow of water from Cleghorn Springs through the hatchery site averages close to 12cfs.

About 10 cfs of this amount is gauged discharging from the Parshall flume on the settling basin.

Flow rates fluctuate slightly annually, seasonally, and with competitive demand from the Rapid City Jackson Springs pumping station. No significant fluctuations have occurred in the chemical nature of the water supply since 1973. Water levels were fairly stable this year. An application to

update the water rights to the correct historical use level was filed and argued before the water board in December 2002. The outcome of the application is still pending at this time.

FISH CULTURE ACTIVITIES

The large rainbow trout program continues to be very popular. No significant problems were encountered getting them up to size. Floating extruded pellet diets with canthaxanthin, a pigment that enhances skin and flesh color, continues to produce pleasing external and internal color in the rainbow trout. Some fish losses occurred from low oxygen problems associated with the low inflow head on the raceways. A stand pipe blew off in the middle of the night dewatering ponds containing 1200 rainbow trout brood stock and 10,000 trout destined for Pactola Reservoir. This is continuing problem with the deteriorating raceways and drain system has been identified as a critical issue in the capital budget planning process. On the 15th of December the main water pump failed and emergency repairs were undertaken. It took about two weeks to get the pump rebuilt and installed. During that period the engine on the back up pump failed. The outside fish were put on gravity flow and reduced feed levels, while the inside fish were kept alive using portable gasoline fueled pumps and in-line oxygen contactors developed earlier for emergency backup. The facility was staffed 24 hours a day to keep the pumps fueled and monitor the oxygen levels at critical check points. The facility operated under critical conditions for nearly 3 weeks as both main pumps were repaired and oxygen system problems were dealt with. No fish were lost during this period although reduced feeding levels resulted in slightly undersized fish stocked during the first part of the season. Time spent developing and practicing emergency procedures was the key to successfully protecting our investment.

RESEARCH AND DEVELOPMENT

Liquid Oxygen System

The liquid oxygen project developed by the hatchery staff went on line February 27, 2002. The three thousand gallon liquid oxygen tank with evaporator was installed on a concrete slab immediately adjacent to the oxygen building on the west side. The original projected monthly cost for oxygen was about \$1,200 month, the last billing for a 45 day period was \$1,800. It appears from limited data that the economic goals have been met. The improvement in reliability to 99.99% is worth a lot of money but is more difficult to quantify. Maintenance cost for the year has been \$0.0.

The hatchery reconstruction project has struggled to get off the ground. Indecision on how to proceed culminated a combination contract

FISH HEALTH.

Fish health management continues to be a very low level activity. Strict adherence to acceptable loading and fish husbandry techniques has prevented any detectable acute losses of fish. Annual inspections are conducted for each lot of fish on station and no occurrence of any tested pathogens has been reported. There have been some episodes of fin damage associated with mechanically induced water quality problems. Anticipated capital improvements will eliminate these problems.

EFFLUENT WATER QUALITY

Cleghorn Springs Trout Hatchery is in the process of renewing its NPDES permit SD-0000060. Discharge limits are summarized in Table 5. Careful production programming and operating keep water quality within the permit limits set by the Environmental Protection Agency. Water is sampled and analyzed weekly for TSS (total suspended solids), BOD (biological oxygen demand), pH and monthly for ammonia. A quarterly sample taken during pond cleaning is tested for TSS and ammonia. Nitrogen-ammonia levels did not exceed 0.5 mg/l, and remained fairly constant ranging from 0.0 to 0.5 mg/l throughout the year (figure 3). Total suspended solids ranged from 4 to 5mg/l (Figure 2). Biological oxygen demand (BOD) ranged between 1.0 and 4.75 mg/l (Figure 3). Total suspended solids ranged from 172 to 268 lbs/day with an average of 230 lbs. /day being produced (Figure 3). The mean monthly pH level was 7.5 with a range of 7.2 to 7.56 (Figure 4). Mean monthly water usage in millions of gallons per day was 6.75 with a range of 4.95 to 8.29 (Figure 5).

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Lot histories provide an archive of production data that is useful for long range production and cost analysis. This information shows the cost relationships among sizes of fish as well as other production costs that may vary by year or program. Since fish cost is a function of its rearing time in the hatchery, there is an averaging effect for a given lot of fish when stocked over an extended period of time. This would be most evident for catchables and broodstock. The information included for each lot starts with the species. The species code follows the Federal fish species acronym list. The first group of letters identifies the specie(s), after the dash if applicable, is a single letter that identifies the strain, followed by the year obtained and finally a letter that designates either fall (F) or spring (S) spawned. A list of strains follows.

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G.....	Growth
K.....	Kamloops
L.....	Fish Lake
M.....	McConaughy
O.....	Oahe
S.....	Shasta

Species	Brown trout	Rainbow Trout	Rainbow Trout	Rainbow Trout	Rainbow Trout
Lot	BNT-P98F	RBT-C98F	RBT-C99F	RBT-K97BR	RBT-C00BR
Source	Saratoga	Cleghorn	Cleghorn	Cleghorn	Cleghorn
Date Received	11/3/98	9/98	8/99-11/99	8/97-10/97	8/00-10/00
# @ Initial Feeding	20,000	375,000	110,000	800	7,700
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Feed fed 2002 (Kg)	250	5577.1914	rbtc99f	0	0
Wt. Gained 2002 (Kg)	149	4615	12935	916	30
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Cost per kilogram	\$22.55	\$9.11	\$9.33	\$8.91	\$9.36

Species	Rainbow Trout	Rainbow Trout	Rainbow Trout	Rainbow Trout	Rainbow Trout
Lot	RBT-C00F	RBT-M99S	RBT-M00S	RBT-S99S	RBT-S00S
Source	Cleghorn	Ennis NFH	Ennis NFH	White Sulphur	White Sulphur
Date Received	8/00-10/00	01/26/1999	01/25/2002	1/10/99&2/23	02/16/00
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Wt. 1/1/00	0	1944		7700	0
# Stocked 2002	-	21,159	128,727	69,455	39,819
Wt. Stocked 2002 (Kg)	0	2,880	474	15,216	440
Feed fed 2002 (Kg)	398.2	1334.454	2949.1	9974	4651.1542
Wt. Gained 2002 (Kg)	563	936	3122	7516	7185
Conversion	0.71			1.33	0.65
# On Hand 12/31/00	149,213	-	37,400	-	92,724
Wt. On Hand 12/31/00	563	-	2,648	-	6,745
C.Y. 00 Production Net Cost	\$5,270	\$8,761	\$29,223	\$70,352	\$67,253
Labor	\$2,687.61	\$4,468.21	\$14,903.60	\$35,879.38	\$34,299.27
Facility and Operations	\$2,582	\$4,293	\$14,319	\$34,472	\$32,954
Cost/Kg C.Y. 00	\$9.36	\$9.36	\$9.36	\$9.36	\$9.36
C.Y. 99 Accrued Cost	\$0	\$29,985	\$0	\$68,137	\$0
C.Y. 99 AccruedProd.	0	3536	0	8035	0
Total Accrued Production	563	4472	3122	15551	7185
Cost per kilogram	\$9.36	\$8.66	\$9.36	\$8.91	\$9.36

Table 1. Calendar Year 2002 Stocking summary by program, species:
Rainbow trout (RBT), brown trout (BNT), size and cost.

Program	Species	Size	Number	Weight	Cost
Large Lakes and Reservoirs					
	RBT				
		ADT	228	600	\$5616
		CAT	10,002	1,799	\$16,839
		Program Subtotal	10,230	2,399	\$22,455
Missouri River					
	BNT				
		FNG	6,834	34	\$318
	RBT				
		CAT	21,159	2,880	\$26,957
		FNG	19,025	309	\$2,892
		Program Subtotal	47,019	3,223	\$30,167
Small Lakes and Ponds					
	BKT				
		CAT	26	3	\$NA transported only
		Fng	100	5	\$NA transported only
	BNT				
		ADT	13	6	\$NA transported only
		CAT	391	76	\$NA transported only
	FCS				
		CAT	18	3	\$0
		FNG	1	0.05	\$0
	RBT				
		ADT	2,752	4,503	\$42,148
		CAT	98,743	22,733	\$207,823
		FNG	211,814	1,115	\$10,440
		Program Subtotal	313,859	28,444	\$266,244
Streams					
	BNT				
		CAT	10,650	2,241	\$20,979
	RBT				
		ADT	2,268	3,035	\$28,410
		CAT	16,355	2,546	\$23,830
		Program Subtotal	29,273	823	\$73,223
Grand Total			400,381	41,889	\$392,092

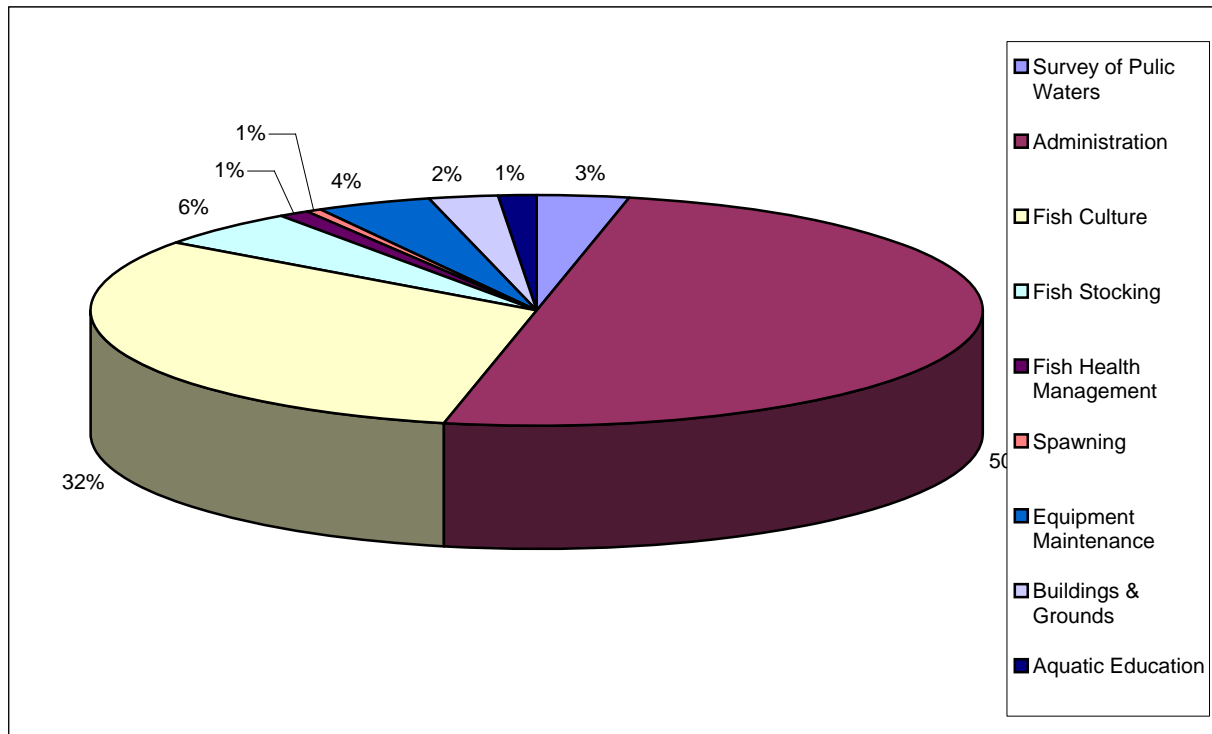
Table 2. Calendar Year 2002 Operating Expense Summary

Salaries and Benefits	\$176,187
Travel	\$1,543
Contractual Services	\$168,949
Supplies and Materials	\$78,415
Capital Assets	\$9,214

Table 3. Summary of 2002 spawning showing number of eggs produced at Cleghorn, number transferred to McNenny State Fish Hatchery and number received from other sources by date and strain.

Year2002		Total Eggs:	1434758	Total Transferred	311305
Strain	RBT-C00F	Total Eggs	780729		
	Source	Strain	Total Eggs for Day	Transferred to McNenny	
08/30/2002	Cleghorn	RBT-C00F	82839	41430	
09/05/2002	Cleghorn	RBT-C00F	128340		
09/12/2002	Cleghorn	RBT-C00F	172002	172002	
09/19/2002	Cleghorn	RBT-C00F	97875	97875	
09/26/2002	Cleghorn	RBT-C00F	144035		
10/03/2002	Cleghorn	RBT-C00F	63101		
10/10/2002	Cleghorn	RBT-C00F	92540		
Strain	RBT-C97F	Total	163698		
	Source	Strain	Total Eggs for Day	Transferred to McNenny	
08/16/2002	Cleghorn	RBT-C97F	79818		
08/23/2002	Cleghorn	RBT-C97F	83881		
Strain	RBT-M00S	Total	333125		
	Source	Strain	Total Eggs for Day	Transferred to McNenny	
01/25/2002	Ennis	RBT-M00S	333125		
Strain	RBT-S00S	Total	157205.		
	Source	Strain	Total Eggs for Day	Transferred to McNenny	
2/16/2002	White Sulphur Springs	RBT-S00S	157205		

Figure 1. Labor Distribution by Task.



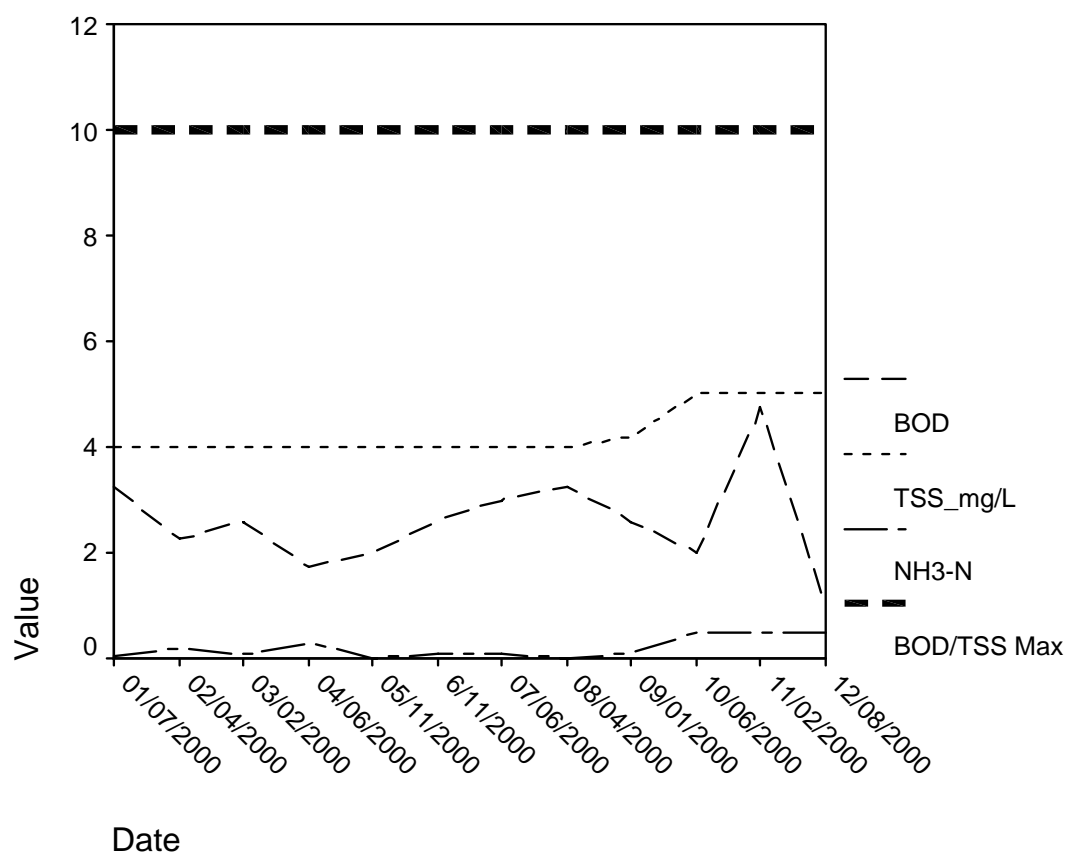


Figure 2. Mean monthly water quality samples taken from the flume (hatchery effluent) showing nitrogen-ammonia (NH₃-N), total suspended solid (TSS), and biological oxygen demand (BOD). Also shown are the daily maximum allowable limits for TSS and BOD.

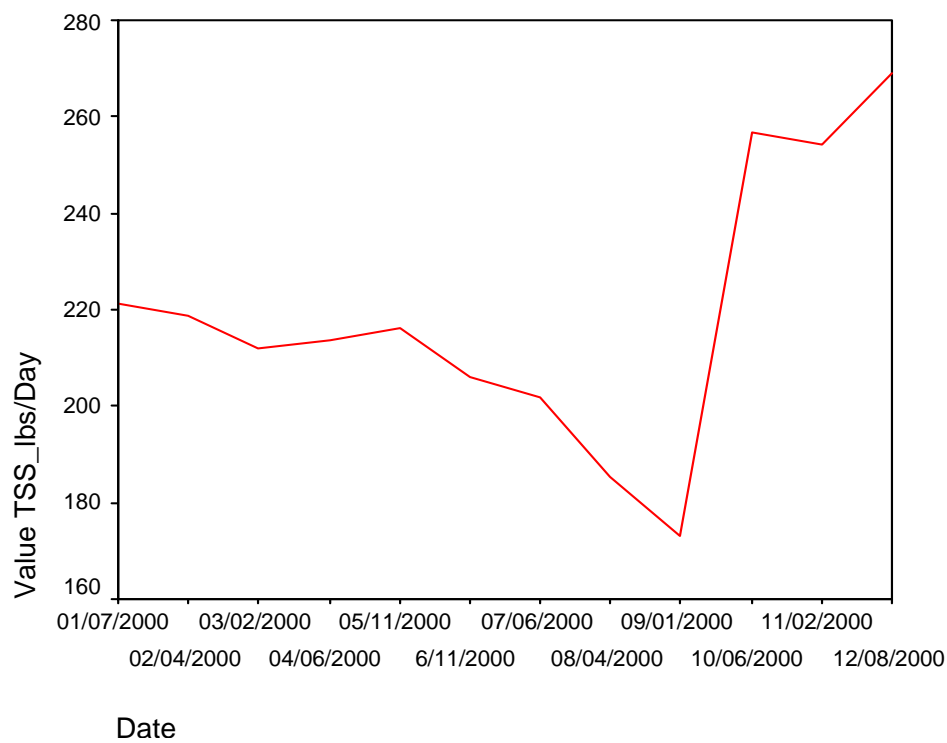


Figure 3. Mean monthly calculated total suspended solids from hatchery effluent. .

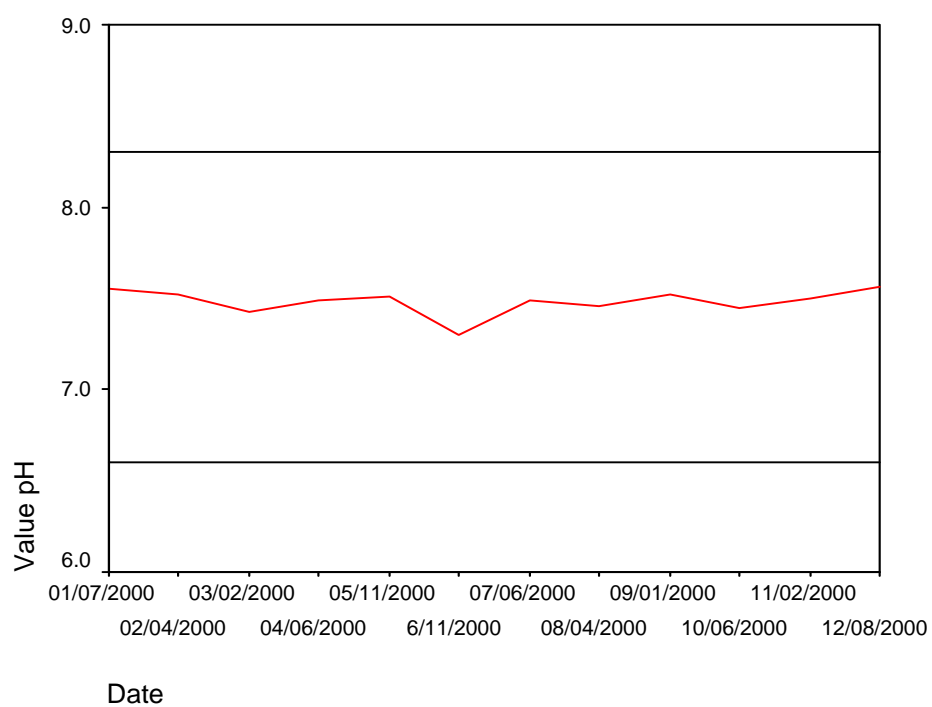


Figure 4. Mean monthly pH levels from hatchery effluent with daily minimum and maximum levels.

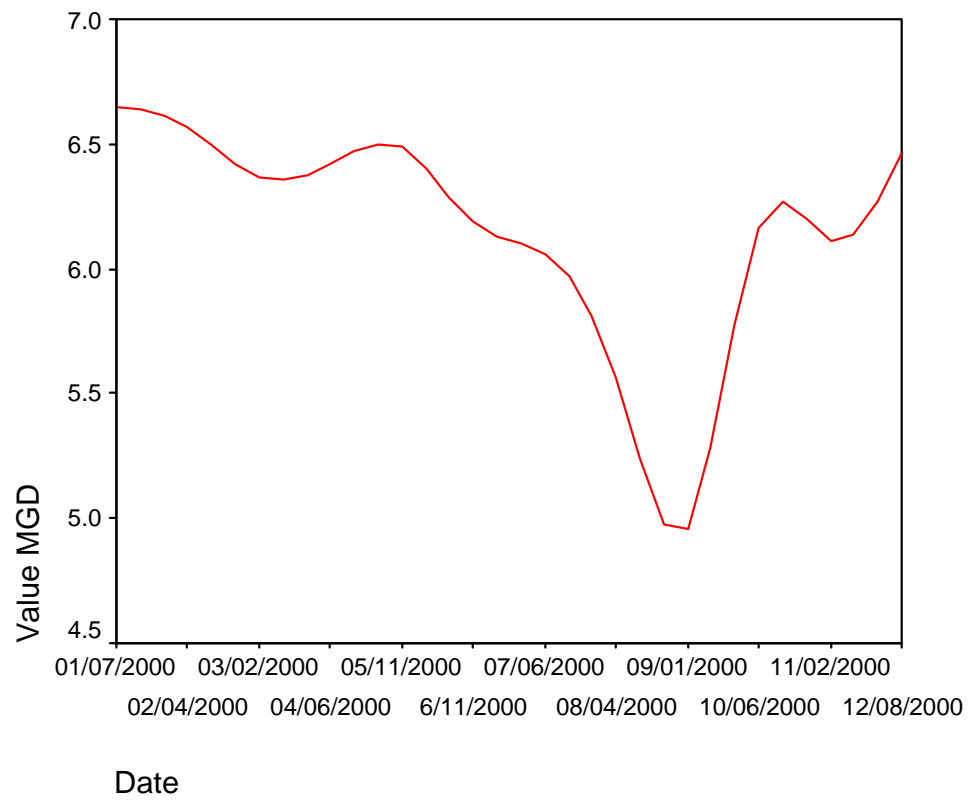


Figure 5. Mean monthly water usage in millions of gallons/day.